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ORIGINAL ARTICLES

PRESIDENT'S ADDRESS*

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IT IS with a keen appreciation of the honor you have conferred upon me, and it is with great pleasure that I welcome you to Colorado for this the twenty-eighth annual meeting of our Society. It has been nineteen years since the American Society of Orthodontists met in this state. During that time the Society has greatly increased in membership and in power. The science and art of orthodontia have made great advances, largely through the work of our members. This Society is a clearing house where new ideas may be discussed in an impartial, scientific manner, so that the weak ones may be eliminated and the strong retained.

Time will not permit my dwelling upon the different phases of advancement in orthodontia, for we have a very full program, a program which is a tribute to the splendid work of our Board of Censors and of our Executive Committee. I shall be obliged to confine my remarks to recommendations for action, which many of our members believe will redound to the betterment of our Society and to the advancement of the knowledge of orthodontia. You will recognize some of these recommendations as having been proposed by my predecessors.

The first problem for consideration is that of education and economics. The charge is made that the education of the specialist in the healing art is too expensive, both in time and in money. Let us consider the cost of the education of the orthodontist. First he must have one or two years of predental work in a university. He must then have three or four years in a dental college, depending upon the plan, whether it is the 1-4, the 2-3, or the 2-4 year plan of predental and dental instruction; a total of five or six years, fol-

*Read at the Twenty-eighth Annual Meeting of the American Society of Orthodontists, Estes Park, Colorado, July 16, 1929.

lowed by a postgraduate course in orthodontia. Thus his dental and orthodontic education has cost him six years or more of his life's span. Under the plans outlined above there is a loss of nearly one-third of the student's time, due to vacations. Moreover, during vacations the enormous investment in the educational plant is nonproductive, entailing a loss that must be charged to the cost of education. Could any business enterprise pay dividends if the investment in plant, equipment, and in personnel be idle from one-fourth to one-third of the time?

A plan to shorten the course of training for the person desirous of engaging in the practice of orthodontia has been advocated by certain orthodontists and already adopted by one state. The plan advocates two years of premedical or predental and three years of dental instruction, essentially orthodontia, of nine months each, or a total of forty months of instruction, mid-term vacations being deducted. Then without acquiring the dental degree, one may be entitled to take an examination from a State Board of Dental and Orthodontic Examiners, and receive a license permitting practice in the specialty of orthodontia. The advocates of this plan claim for it that the orthodontic undergraduate need not have crown and bridge or denture technic or clinical instruction, and that the time saved thereby may be devoted to orthodontic instruction. They claim that a competent orthodontist may be graduated after twenty-four months of undergraduate dental instruction in a course majoring in orthodontia.

Others claim, conversely, that to safeguard the welfare of the public, the orthodontist must first of all have that broad knowledge of dental disease, of diagnosis, of treatment and of reconstruction which the dental degree implies. This must be followed by a postgraduate course in orthodontia. They claim that shortening the course of instruction will attract the indolent student. James McCoy has described the situation in terse language, as follows: "Having the regular dental course and the postgraduate course also, the orthodontist would be a Dentist plus. Having only the short course he would be a Dentist minus."

Some of our most prominent medical and dental educators are advocating still another plan, the quarterly system; viz. four quarters of eleven or twelve weeks each. By this plan a great saving in time and money is accomplished, as the four-year course may be completed in three calendar years. I am happy to report that the dental departments of four of our large universities are now offering the quarterly plan of instruction.

However, regardless of the plan of education and the resultant cost, it is of greater importance, even vitally necessary, that the orthodontist apply the principles of economics in the conduct of his practice, such as the arrangement of office space, for efficient handling of patients, by taking advantage of cash discounts, conserving his own time, etc. The orthodontist may also conserve time through educating the public and the school officials to the importance of a dental or an orthodontic service, so that the children for whom he needs a long sitting may be excused from school, thus spreading out or reducing his peak load.

A decidedly economical and educational advantage to the young orthodontist is an association with an older orthodontist who is progressive and who has ripe judgment. Such an association will prevent many mistakes in diagnosis and treatment on the part of the young orthodontist, and the public will benefit thereby, economically, as well as in better professional service. Unfortunately, too many experienced orthodontists shun the financial and moral responsibility of sponsoring the work of the inexperienced orthodontist, so that opportunities for young orthodontists to associate themselves with experienced men are few and far between.

The men practicing a specialty independently are usually strong in the trait of individualism and accustomed to independent action. This is an admirable quality when controlled, but if founded on an exalted ego it often produces an attitude of intolerance which leads to eccentricity of words and actions. Through constant consultation with fellow practitioners, where the interchange of ideas is so helpful, this undesirable trait of intolerance is less likely to develop.

At our last annual meeting President Walter Ellis recommended the formation of an Education Committee. The duties of this committee and method of appointment, time of servcie, etc., were not clearly defined. Therefore, I recommend that a resolution be introduced for consideration at our business session, creating a standing committee to be known as the Education and Legislation Committee, to be elected from nominations made from the floor. This committee to be composed of five members, one member to serve one year, one member for two years, one for three years, one for four years, one for five years, and one to be elected annually thereafter to serve for the maximum number of years. The chairman of the committee to be appointed by the president.

The work of our Education Committee in studying several problems has been of great value. First, that presented through the legislation proposed in California to govern the education for and the practice of the specialty of orthodontia; second, the law which was enacted last winter in Arizona.

It has also given consideration to the formulation of a suggested course of orthodontic instruction for the undergraduate student, and to planning a course of instruction for the postgraduate student of orthodontia. This committee is also considering a primary subject of the utmost importance, viz., methods for determining the natural aptitude of the prospective dental and orthodontic student for his proposed course. It is planned that the results of these studies be supplied to dental schools and colleges upon request.

In a few years the younger orthodontists will be taking the places of our older members. Should we not leave a heritage of training which will enable them to reach higher attainments, thus elevating orthodontia to a higher plane?

I recommend that our Education Committee consider the feasibility of establishing an American Society of Orthodontists Study Class, meetings to be held for one week preceding our annual meeting, in the same city where the meeting is to be held; or, if at a different time of the year, to be held at some university, first in one section of North America and then in another.

This course is to be self-supporting, and in the beginning to be open to members of the American Society of Orthodontists only.

Our Education Committee has outlined a plan for the creation of an American Board of Orthodontia which shall examine applicants, and if they are found proficient, issue a certificate of fitness. This plan is patterned after the American Board of Otolaryngology and the American Board for Ophthalmic Examinations, which have been found to be successful, each filling a need in its respective field. The American Board of Otolaryngology is incorporated under the laws of a state. Its certificate of fitness has no legal standing but is a powerful psychologic factor in stimulating specialists to acquire increased knowledge and skill in their respective branches. The majority of the component societies and also certain colleges and hospitals require that applicants for membership or for a position on the staff shall possess such a certificate.

Our nomenclature as generally used is faulty. Our terms are often misleading. I believe that most orthodontists and dentists have forsaken the terminology of "superior" and of "inferior," but we speak of upper or lower cuspids and bicuspids instead of using the approved terms, maxillary or mandibular canines and premolars. Some may speak of Class I, II, and III cases, others of neutroclusion, mesioclusion and distoclusion, or of anterior or posterior occlusion, or of protraction or retraction. At present we have no authorized terms describing the various types of malocclusion. An effort should be made by the men best qualified, such as dental and orthodontic editors and authors, to classify, evaluate and perhaps stabilize our terminology so that we may speak a common language, a language etymologically sound, a language founded on scientific usages.

Therefore, I recommend that a standing committee on nomenclature be created, to consist of five members, to be elected from nominations made from the floor; one to serve for one year, one for two years, one for three years, one for four years, one for five years, and a member to serve for five years to be elected annually thereafter, the chairman of the committee to be appointed by the president. If the majority of our members think best, we may include nomenclature in the duties of the Education and Legislation Committee.

I believe that after hearing the report on orthodontic research which is being conducted by John Albert Marshall, under the Orthodontic Research Grant, you will feel that the money which was appropriated for this purpose last year has been profitably spent. Therefore, I recommend that our Budget Committee include in their report an appropriation of three thousand dollars to continue the research which Doctor Marshall has so ably started at the University of California.

I also recommend that the assessment of $10.00 per member per year be continued for the next three years in order to provide funds for further research pertaining to orthodontia.

My attention has been called to the fact that a few of our members are not members of the American Dental Association. No one will question that a man may be a skillful and an ethical orthodontist or dentist, and not be a member of his national dental association. However, I believe that if a man has an

appreciation of his responsibility as a member of society at large, he will be public-spirited enough to join his local and national dental associations, and thus he will make a better member of our Society. I would further suggest that the orthodontist who feels a responsibility for the success of the orthodontic section of the American Dental Association will make a better member of the American Society of Orthodontists.

I believe that we should consider making additions to our Constitution, these additions leading to advanced requirements for admission. Referring to Article III, Section I relating to membership, you will read, "No person shall be eligible to active membership except those engaged in the exclusive practice of orthodontia for a period of not less than three years," and then in Article IV, Section I, "Election of Members," we learn that the Board of Censors "shall further use due diligence to ascertain the fitness of such applicants for membership."

Looking forward a few years we may anticipate the time when the men who have specialized in orthodontia for three years, after having had the minimum educational requirements authorized in Arizona by law, will be making application to the American Society of Orthodontists for membership, on the basis that they have been in exclusive practice for three years. I am not saying that such a person would not be as capable an orthodontist or as ethical as many others, but I am convinced that he would be a better orthodontist had he first received a broader education in dentistry and earned the dental degree.

There are men who have practiced orthodontia as a specialty for three years or more, who do not appear to have that love for their work which makes for successful treatment of cases. Therefore, I believe that our requirements for admission should include demonstrations of the applicant's fitness. I recommend that applicants for admission shall present a thesis, and also reports of the treatment of a number of cases in marked malocclusion that have been carried through not only the period of active treatment, but also the period of postoperative maintenance until the teeth remain in positions at least approaching normal function or normal occlusion. I think that we all realize that evidence presented showing cases at the end of the first active period of treatment, after six months or a year, is of but doubtful value.

I also recommend that membership in his or her local and national dental societies shall be required of an applicant for membership in our Society.

I further recommend that we create an American Board of Orthodontia, following the plan to be submitted by our Education Committee through the chairman, Oren A. Oliver. This Board to be empowered to examine applicants and to issue certificates of fitness to those found proficient. Examinations to be open to our members and also to other orthodontists who meet the preliminary requirements. Furthermore, if an applicant for membership in the American Society of Orthodontists has received a certificate of fitness from the American Board of Orthodontia, said certificate of fitness shall be accepted in lieu of a thesis and case reports.

In closing, let me say that we may make our lives greatly useful or only commonplace. Let us make them so vitally useful in our chosen specialty that the knowledge of orthodontia may advance apace and be the dominant

factor in the welfare of humanity that it can and should be. Then the many and far-reaching benefits of orthodontia may be enjoyed by that great host of children to whom it will be such a priceless boon.

RESOLUTIONS PASSED BY THE AMERICAN SOCIETY OF ORTHODONTISTS

THE following recommendations proposed in President Ketcham's address were adopted.

WHEREAS, the President has recommended the creation of a Committee on Legislation, the function of which shall be to acquaint themselves with all legislation affecting orthodontia and offer such advice and use such influence as may be within their power to have such legislation and laws passed as will be a benefit to the public; be it therefore

Resolved: That a committee of five men be nominated by the Executive Committee and elected by the general assembly to be known as the Legislative Committee; one member to serve one year, one member to serve two years, one member to serve three years, one member to serve four years, and one member to serve five years, and one member to be elected annually thereafter for a period of five years. The committee shall organize and elect the chairman and secretary.

WHEREAS, the President has recommended a Committee on Orthodontic Education, the duty of said committee to be the study of orthodontic education and to report its recommendations to the Society each annual meeting; be it therefore

Resolved: That a committee be created to be known as the committee on Orthodontic Education, to consist of five members to be nominated by the Executive Committee and elected by the general assembly; one to serve one year, one to serve two years, one to serve three years, one to serve four years, one to serve five years, and one to be elected annually thereafter to serve for a period of five years. The committee shall organize and elect a chairman and secretary.

WHEREAS, the President has called attention to the chaotic condition existing in orthodontic nomenclature; and

WHEREAS, he has recommended the formation of a Committee on Dental Nomenclature, whose duty it shall be to confer and cooperate with the Committee on Nomenclature of the American Dental Association, the Dental Editors Club and similar bodies; be it therefore

Resolved: That a committee be created to be known as the Committee on Orthodontic Nomenclature, said committee to consist of three men nominated by the Executive Committee and elected by the general assembly; one member to serve one year, one to serve two years, one to serve three years,

one to be elected annually thereafter to serve for a period of three years. This committee shall organize and elect a chairman and secretary, and shall make an annual report to the Society, with their recommendations.

WHEREAS, the President has recommended the formation of an American Board of Orthodontia similar to the American Board of Otolaryngology and similar boards formed for the purpose of regulating the specialties of medicine, which boards have rendered valuable service in standardizing and increasing the efficiency of medical specialists; and

WHEREAS, up to this time those engaged in the practice of orthodontia have had varying and sometimes insufficient qualifications for the practice of our specialty; and

WHEREAS, the need of a high order of training is essential to orthodontic practice; and

WHEREAS, there is a need for a body to designate standards of study and other qualifications for those who are to represent the specialty of orthodontia; be it therefore

Resolved: That the American Society of Orthodontists create and sponsor an organization to be known as the American Board of Orthodontia, which shall consist of seven men of unquestionable and outstanding reputation and accomplishment in the science of orthodontia, who shall be nominated by the Executive Committee and elected by the general assembly at large; one to serve for a period of one year, one to serve for a period of two years, one to serve for a period of three years, one to serve for a period of four years, one to serve for a period of five years, one to serve for a period of six years, and one to serve for a period of seven years; and one to be elected annually thereafter to serve for a period of seven years. The nominations made by the Executive Committee shall not be voted upon until the following day thereafter. Three-fourths of the votes cast shall be necessary to elect a nominee a member of the American Board of Orthodontia. The Board shall organize and make rules regarding the requirements for examination of candidates for the granting of certificates of fitness, and to make such other rules and regulations as it may deem necessary for the proper functioning of the Board.

The President has called the attention of the Society to the fact that all members of the American Society of Orthodontists are not members of the local, state and national dental organizations. The Committee recommends that the secretary of the American Society of Orthodontists notify these members that it is the opinion of the American Society of Orthodontists that all of its members should affiliate themselves with their local, state and national dental organizations, and respectfully requests such members to make application for membership in their local, state and national bodies.

The Committee furthermore recommends that Article III, Section 1, of the constitution of the American Society of Orthodontists be amended to read as follows:

Article III, Section 1, Active Members: No person shall be eligible to active membership except one who has been engaged in the exclusive practice of orthodontia for a period of not less than three years and who is an active member in his or her local, state and national dental association and who has a D.D.S. or a D.M.D. degree.

The Committee recommends that the Society instruct the Budget Committee to include $3,000 to be spent in continuing research under the Orthodontic Research Grant of the University of California.

Resolved: That an assessment of ten dollars per year be made for the years 1930, 1931 and 1932, the same to be used for the purposes of orthodontic research.

Resolved: That the American Society of Orthodontists in regular session assembled condemns the Arizona law (Senate Bill 8) as being detrimental to the dental profession and a law which will operate as a disadvantage to the public; and furthermore, be it

Resolved: That this Society also condemns such proposed laws as tend to make a distinction between the legal rights of the dentist and orthodontist.

BONE ATROPHY AND ABSORPTION*†

By J. Albert Key, B.S., M.D., St. Louis, Mo.

THE word atrophy is usually defined as the wasting or diminution in size of a part, but in speaking of bones we apply the term atrophy to all of those conditions in which the total amount of earthy matter in a given bone is less than normal. This may be due to a decrease in the size of the bone or to a decrease in density. The term concentric atrophy is applied to conditions in which the diameter of the bone is decreased (periosteal absorption) and excentric atrophy to those in which the diameter of the bone remains practically unchanged while the medullary canal is enlarged and the cortex is thinned. Concentric atrophy usually occurs in flat bones and excentric atrophy in long bones. Halisteresis is the condition in which the organic matrix of the bone remains intact while the lime salts are dissolved (decalcification in vivo). Bone resorption is the removal of bone substance and may result in gross defects in the bone. Atrophy is the result of diffuse resorption.

In this paper I shall discuss briefly the causes and pathology of bone atrophy, the mechanisms of bone resorption, and the various types of bone atrophy and resorption.

CAUSES OF BONE ATROPHY

While bone is a hard unyielding substance, it is by no means a static tissue; but during life it is constantly undergoing change of substance and architecture. Not only is this true during the period of growth but it is also true of adult bone, and the maintenance of normal bone volume and architecture in the adult is the result of a delicate equilibrium between constant bone resorption and the formation of new bone. Growth or hypertrophy occurs when new bone formation is in excess, and atrophy occurs when bone resorption is in excess.

The skeleton is laid down according to a definite plan in the embryo, and the embryonic bones are endowed with the capacity to grow in certain directions and develop into definite shapes. Wolff,[1] Koch[2] and others have shown that the form and architecture of the bones are such that with the use of as little bone material as possible they are mechanically adapted to resist the forces which are brought to bear upon them. In other words, their structure is in accord with engineering principles. Furthermore, if their function is altered, definite changes occur in their architecture which enable the bones to meet the new requirements in a mechanically efficient manner.

For the production and maintenance of a normal bone it is necessary to have (1) a normal bone anlage; (2) normal nutrition, environment, and function during the growing period; and (3) normal nutrition, function and envi-

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†Read before the American Society of Orthodontists, Estes Park, Colo., July 16-19, 1929

ronment during adult life. Abnormally small, short, or soft bones may result from: (1) congenital hypoplasia; (2) hypoplasia due to postnatal influences which retard bone development; (3) loss of mineral content by normal bones.

1. In certain individuals the bones have approximately the normal form and external architecture but due to some defect in the mesenchyme remain porous and brittle. These bones are smaller in size and more fragile than normal. We thus have a condition resembling bone atrophy which is not metabolic in nature but is due to a congenital hypoplasia of the mesenchyme (Key[3]), and the condition may or may not be hereditary (Fig. 1). The condi-

Fig. 1.—Hereditary hypolasia of the mesenchyme. Mother and daughter, deformities are due to fractures (brittle bones and blue sclera).

tion is frequently associated with other anomalies especially blue sclerae and deafness.

On gross examination the bones are found to be unusually hard but brittle. The deformities are the result of mal-united fractures (Fig. 2) rather than of bending of the bones. On microscopic examination it is found that the cortical bone is honeycombed with numerous large canals which are filled with a loose vascular connective tissue (Fig. 3). The walls of the canals are lined with osteoblasts, and these cells are considerably more numerous than in normal bone. The inferiority of the bones is not due to a lack of osteoblasts but to the inability of these cells to form normal bone. This is not due to lack of material, because the mineral metabolism is normal. In spite of the inability

of these bones to attain a condition of normal strength they heal with unusual rapidity when fractured. The brittleness is probably due to some defect in the organic matrix and also to the fact that the lamellae are laid down in an irregular manner and are frequently interrupted by the canals.

2. According to Roux[4] the form and structure of bones is the result of the forces exerted upon them by the muscles and surrounding viscera, and the inherent tendency of the bone anlage to develop in certain directions is non-existent. I believe that this is carrying the theory of functional adaptation

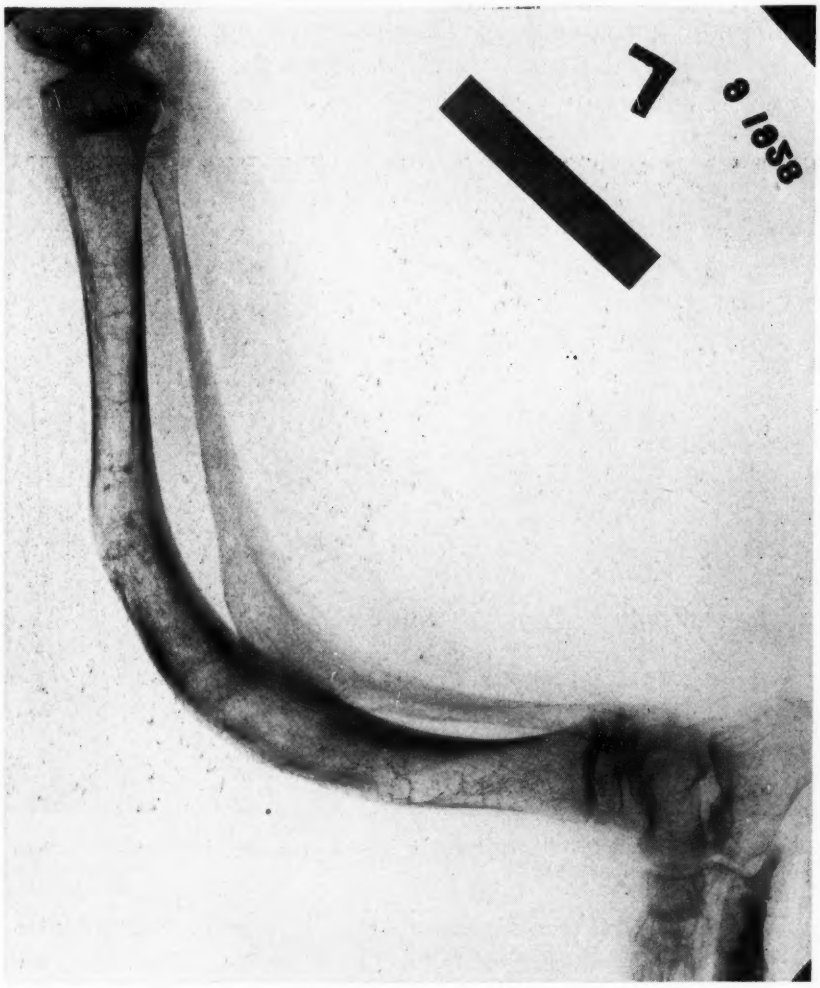

Fig. 2.—X-ray of leg of patient shown in Fig. 1.

to extremes, but there can be no question that bones do have the capacity of responding to stimuli and that their growth may be influenced by forces within the organism as well as by external forces. For this reason, if during the period of growth the muscles of an extremity are paralyzed or inactive over a long period, the bones of the extremity are smaller and often shorter than normal. We have then numerous examples of bones which are abnormally small because during the growing period they have lacked the necessary stimuli supplied by muscle tone and function.

It is further to be noted that occasionally bones are abnormally short because of premature union of the epiphysis to the diaphysis or because of injury to the epiphyseal cartilage plate. In each instance the defects are permanent. The chemical composition and the microscopic structure of these small bones are normal, unless they have been subjected to some other influence capable of producing atrophy.

3. Since normal growth and maintenance of bone are dependent upon an equilibrium between resorption and new bone formation, atrophy of normal bone may result from either acceleration of absorption or inhibition of new bone formation, or a combination of the two. The influences leading to bone atrophy may be general conditions which affect the entire skeleton or local conditions which affect only certain bones or extremities. The important gen-

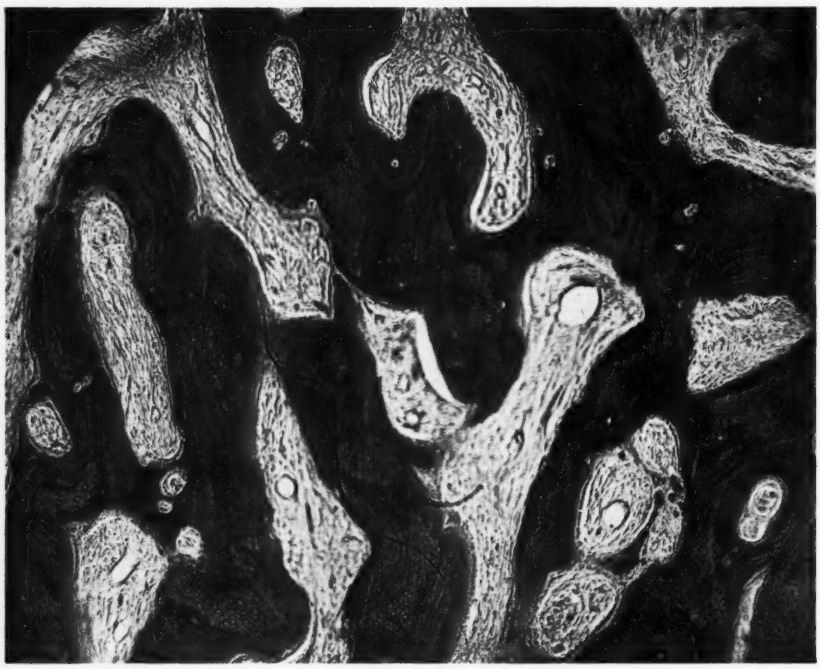

Fig. 3.—Section of cortical bone from brittle bones and blue sclera. Note the wide canals and irregularity of trabeculae.

eral causes are: senility, hunger, marasmus, biliary and pancreatic fistulas, increased metabolism, scurvy, rickets, and osteomalacia. The local causes are: disuse, traumatism leading to acute bone atrophy, inflammation, neoplasms, pressure, and neurotrophic disturbances.

MECHANISM AND GENERAL PATHOLOGY OF BONE ATROPHY

Bone is a material composed of an organic matrix which is impregnated with inorganic salts, chiefly phosphates and carbonates of calcium. The relation between the organic and inorganic constituents is very intimate, but as yet we have no evidence that there is any actual chemical union between them. Its structure may be likened to that of a plaster of Paris cast, the organic matrix being represented by the crinoline bandage which is responsible for

the toughness and elasticity of the cast while the inorganic salts are represented by the plaster of Paris which imparts hardness and rigidity to the structure.

In a local sense the pathology of bone atrophy is the mechanism by which this dual substance is resorbed or eroded. Theoretically this can occur in any one of six ways or the various methods may be combined. The theoretical methods by which bone resorption may occur are:

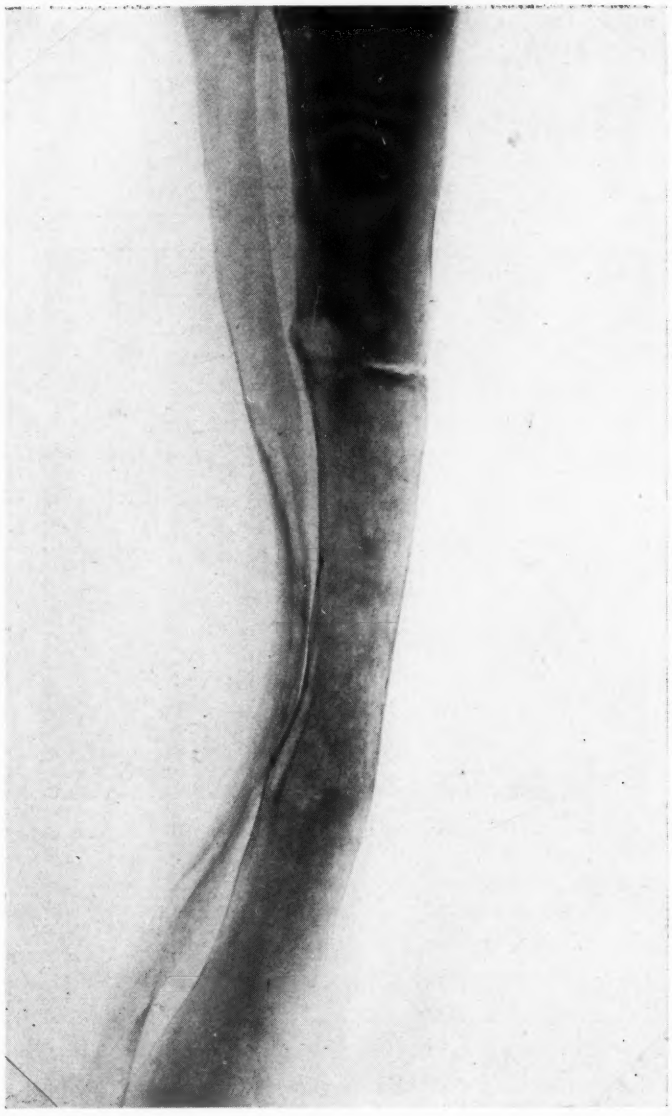

Fig. 4.—Tibia and fibula from case of so-called juvenile osteomalacia. Postoperative. Note normal diameter of bones and very thin cortex.

1. Simultaneous solution of the earthy substance and organic matrix by the surrounding body fluids. This would be the simplest possible method of bone atrophy but apparently it does not occur. We have no evidence that the collogenic tissue is ever soluble in the tissue fluids.

2. Solution of the earthy substance by the body fluids leaving the organic matrix intact. This is the process known as halisteresis or decalcification in

vivo. Whether or not this apparently simple procedure ever occurs is a moot question. Leriche and Policard[5] believe that it is the usual mechanism by which bone is resorbed and that the organic matrix which is left after the calcium is dissolved out undergoes metaplasia and is transformed into various types of connective tissue. However, most investigators deny the occurrence of halisteresis in any except abnormal states, and many authors deny that it occurs even in severe rickets and osteomalacia (Fig. 4). One difficulty is that we have no reliable histologic methods for determining whether or not a given area is calcified, and another is that study of a stained preparation gives us no exact information as to whether the areas of osteoid tissue are decalcified bone or newly formed matrix which has not been calcified. In Fig. 5 practically all of the trabeculae are surrounded by border zones which stain lightly with hematoxylin and are apparently free from calcium. But we do not know whether these are decalcified areas or newly formed osteoid tissue. In order to decide

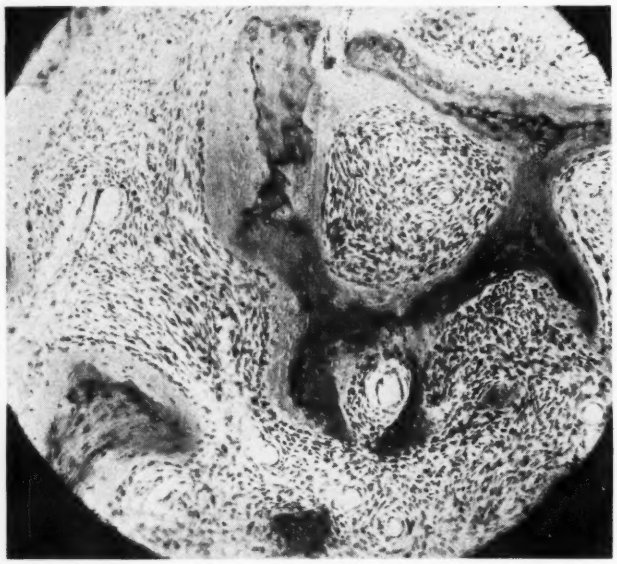

Fig. 5.—Section from bone shown in Fig. 4. Note wide zone of osteoid tissue around the trabeculae.

this question it will be necessary to observe the process of bone absorption over a period of days, and this has been done by Sandison[6] on an isolated bone fragment in a transparent chamber in the rabbit's ear, but he did not state whether or not halisteresis occurred. The presence of calcium free zones around the perforating canals in osteomalacia may be interpreted as either halisteresis or newly formed osteoid tissue, likewise the lattice figures of von Recklinghausen, especially since later authors have noted the same figures in growing bone.

3. Resorption of bone through the activity of living cells. The presence of the multinucleated osteoclasts in Howship's lacunae have convinced practically all observers that these cells do possess and exercise the power of eating their way into the bone substance. Kölliker believed that these cells first secrete an acid (lactic acid) which dissolves the calcium and then digest the organic matrix, but many authors have noted that the lacunae are not

surrounded by a decalcified zone. Wegner[7] believed that the osteoclasts accomplished the resorption in a purely mechanical manner by growth pressure. It is probable that they digest the organic matrix and that the calcium salts are then set free and carried away by the tissue fluids. Bone which is undergoing osteoclastic resorption presents a characteristic serrated edge on section, the indentations being the lacunae (Figs. 12, 16, and 20).

In addition to the lacunar type of resorption smooth resorption is often seen in atrophic bone. This smooth resorption may be produced by osteoclasts which flatten out and apparently move along the bone surface, or by young connective tissue cells and capillaries and by tumor cells (Figs. 17 and 23). It is also probable that osteoblasts may reverse their function and resorb bone which they have previously laid down. It is not possible to determine from a study of sections just how much of the absorption in a given area is due to osteoclasts or to the other cells present in the area.

4. Effects of pressure on bone. It may be accepted as proved that if the forces which a bone is called upon to resist are increased the bone hypertrophies and becomes stronger. This would indicate that pressure tends to cause bone hypertrophy rather than absorption, and we have abundant evidence of this in the readjustments which occur in deformed bones. The most familiar is the thickening of the concave border of bones which have become curved as a result of softening due to rickets and then subjected to weight bearing. An instance of thickening due to direct pressure is shown in Fig. 6. It is an x-ray of a boy 17 years of age with a congenital dislocation of the hip. The head of the femur has been pressing upon the posterolateral surface of the ilium since birth, and it is seen that the bone is considerably thickened at the area of pressure while the original acetabulum is almost obliterated.

On the other hand we have frequent examples that abnormal pressure may cause the appearance of numerous giant cells and result in extensive lacunar absorption. The most familiar examples of the resorption of bone by pressure are the erosions of ribs, sternum or vertebrae by aneurysms. Other instances are the grooving of bones by tendons, the basilar impressions of the skull, and the erosion of the skull by Pacchionian bodies. So striking are some of these that Volkmann said that in spite of its stone-like hardness, bone is more susceptible to pressure than are soft tissues.

It is difficult to understand how an aneurysm exerting a pressure equal to that of the blood (80 to 150 mm. Hg.) can eat its way through bones, while the head of the femur pressing against the side of the ilium and transmitting the body weight every time a step is taken, causes not erosion but hypertrophy and increased density in the underlying bone. In these instances it cannot be a question of the amount of force exerted, as this is obviously much greater in the congenital hip. Nor can it be a question of the duration of the force, as was thought by Schmidt,[8] as this also is longer in the case of the hip. Roux believed that the direction of the force was important and that pressure on a periosteal covered surface causes atrophy while that on a surface covered by cartilage does not. The case of the hip disproves this, as the pressure is lateral to a surface which is not normally subjected to pressure and which is covered by periosteum.

Jores[9] attempted to solve the problem in an ingenious manner. He strapped rubber bags of mercury or water to the backs of guinea pigs and rabbits and then studied the spinous process. The experiments lasted from 30 to 60 days and in some instances the pressure was applied intermittently. He found no macroscopic changes, but from his histologic studies concluded that bone resorption occurred during the period of pressure and that bone repair and hypertrophy occurred during the intermissions when the spines were free from pressure. This is a very attractive theory, but again it is disproved by the case of the hip, because here we have an area that is practically

Fig. 6.—Congenital dislocation of the hip. Note the bone thickening on the side of ilium at the point of pressure and obliteration of acetabulum.

never free from pressure, as the normal muscle tone presses the femur against the ilium during the time when it is not bearing weight, though of course the pressure is much less. Furthermore, in operating upon cases of tuberculosis of the spine with a kyphosis, I have often noted that the tips of the spinous process over the kyphos were unusually broad and hard. These patients had been recumbent for some months, and the prominent spinous process had been subjected to an unusual amount of pressure and had become hypertrophied.

We must admit then that generally speaking the amount, duration, direction, or intermittent character of the pressure have not been shown to explain the atrophy or hypertrophy which occurs in bones when subjected to abnor-

mal pressure. Having admitted the above I wish to qualify the statement to the extent that there are of course limits to the amount of pressure which bones can stand and that this is considerably less in atrophic bone. Fig. 7 shows the lateral views of two bones each of which has been perforated by a pin to which pressure has been applied. The bone on the left is a markedly atrophic tibia in a case of infantile paralysis. The bone on the right is a rather robust femur in a girl with congenital shortening of that bone. The pin through the tibia was subjected to sufficient pressure to lengthen the paralyzed leg two inches (about 20 pounds) while the pin through the femur was subjected to about 70 pounds pressure for about the same length of time. The pinhole in the atrophic tibia was considerably enlarged by the pressure upward on the pin while that in the robust femur remained practically unchanged, although it was subjected to about three times as much pressure. These are of course extreme cases and are not to be compared with the usual

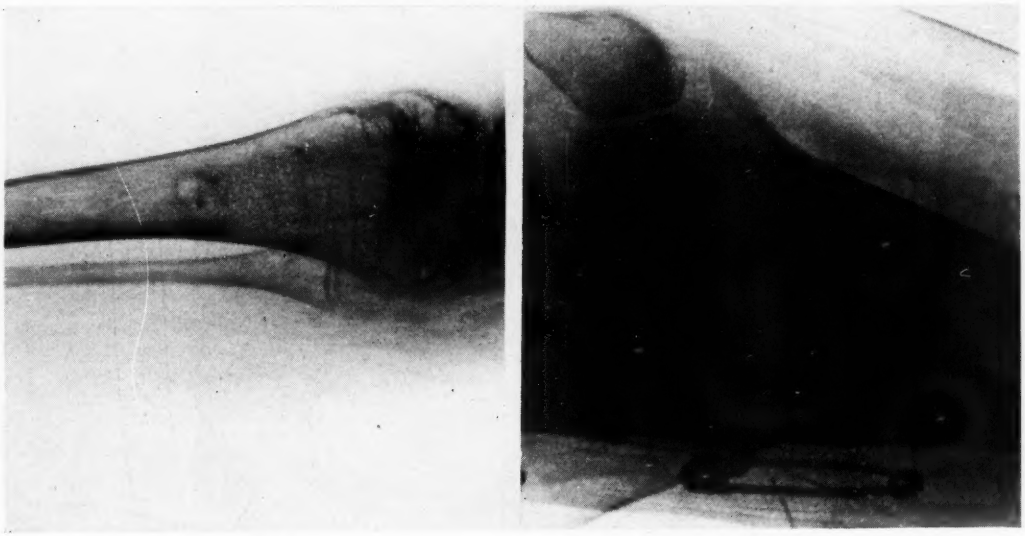

Fig. 7.—Effect of pressure on bone. Note enlarged pinhole in the shaft of atrophic tibia and scarcely visible hole in shaft of normal femur which was subjected to three times as much pressure.

forces to which bones are subjected during life, and they help us very little in answering the question of the effect of pressure on bone. And we must leave the answer to future researches because we have no satisfactory explanation of the various phenomena which are known to occur. It occurs to me, however, that the important factor is the agent which exerts the pressure.

5. Wearing away of bone by friction. In the normal individual the bones are protected by soft tissues and cartilage and are not subjected to friction. It is reasonable to assume that were two unprotected bony surfaces to be rubbed together over a long period of time there would occur a gradual wearing away of the surfaces. But such apparently is not always the case. Every orthopedic surgeon has seen bones, hips especially, from which the cartilage has disappeared as a result of arthritis and which have been subjected to years of friction and pressure. These bones are not eroded, but are very hard and ivory-like in structure, and their surface is highly polished. On the other

hand, if the head is resected or the neck of the femur is broken, the remainder of the neck may be rapidly and completely absorbed and the hip subluxated. The factors which determine which process will occur are at present poorly understood.

6. Disintegration of bone due to change in the organic matrix. It is obvious that if the organic matrix of a bone deteriorates in quality in such a way that it loses its toughness or elasticity, the bone will disintegrate under the stress and strain of normal physiologic use. It is believed that the Charcot joints of tabes and syringomyelia are the result of some such change in the bones. We call them neurotrophic joints because we beleive that the damage to the nervous system in some way interferes with the nutrition of the bone, but we do not know how this change is brought about or what the nature of the change is.

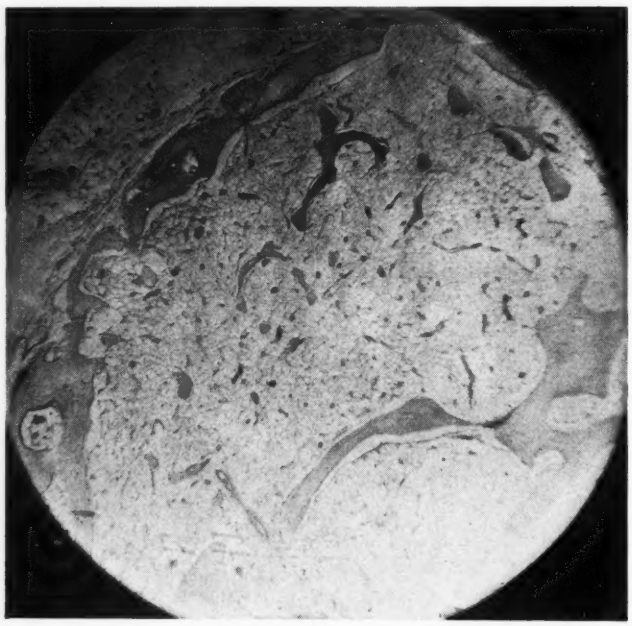

Fig. 8.—Low-power view of cortex and cancellous bone in the lower end of an atrophic femur. Chronic type due to ankylosis. Very few osteoblasts in the tissue.

CHARACTERISTICS OF ATROPHIC BONE

A bone which has undergone atrophy is lighter in weight, slightly smaller in diameter, and weaker than a corresponding normal bone. If the atrophy has occurred during the growing period, there may be some shortening in the case of a long bone, and the diameter may be considerably reduced. If the bone be sectioned, it will be found that it cuts more easily than normal and the cortex is thinned, while in the cancellous portion the trabeculae are decreased in size and number. In extreme instances the cortex is roughened on the periosteal surface and porous on the cut surface. It is often noted that atrophic bone is hyperemic and during operative procedures bleeds more freely than does normal bone.

When it is examined by means of the x-ray, atrophic bone casts a shadow which is less dense than normal, and the thinning of the cortex and rarefac-

tion of the cancellous bone are evident. In addition to the above both cortical and cancellous bone may appear mottled, the substance being spotted with numerous circumscribed clear areas, or the cortex may show longitudinal striation.

The microscopic changes are less evident. If the atrophy is in the acute stage and is progressing rapidly, one may expect to find numerous osteoclasts and extensive lacunar resorption (Figs. 12 and 16). In chronic atrophy the trabeculae are small and the sides are covered by flattened osteoblasts, while the cortex is thinned and the vascular canals are often dilated, but there may be no evidence of lacunar resorption (Fig. 8). In either case one is usually able to find some evidence of new bone formation.

SPECIAL TYPES OF BONE ATROPHY

1. Senile atrophy occurs in varying degrees in aged individuals and affects practically all of the bones of the skeleton. The flat bones, as the skull, pelvis and shoulder blades, are especially affected in areas where no muscles are attached, and the atrophy may be so extensive that gross defects are created in these bones. The alveolar processes shrink to such a degree that the teeth are loosened and the jaw may be fractured by chewing. The frequent fractures of the hip, upper end of the humerus and lower end of the radius in old people are largely the result of senile atrophy affecting the cancellous bone in these regions (Fig. 9).

The cause of senile atrophy is unknown. Cohnheim regarded it as a physiologic change such as affects the thymus, ovaries, and certain other organs with age, the ability of the cells to reproduce themselves being gradually lost. Recklinghausen considered it a nutritional disturbance and not a true atrophy. It has also been considered to be neurotrophic in origin.

Pathologically the picture presented by senile atrophy is not characteristic, and varies from extensive lacunar resorption by osteoclasts to pictures suggesting halisteresis such as are found in osteomalacia. In addition to the loss of bone substance there is also some deterioration in the quality of the bone as Wertheim[10] found that small cross-sections of bone from old individuals were only about one half as strong as similar sections of bone from young individuals. This is probably due to some obscure change in the organic matrix.

2. Hunger atrophy: Until recently most of our knowledge of hunger atrophy has been derived from observations on experimental animals which had been fed a calcium poor diet, but the deprivation of proper food suffered by the population of central Europe incident to the Great War produced thousands of cases of bone disturbances in adolescents and adults. The condition has been rather extensively studied and described as adult and adolescent rickets or hunger osteomalacia. It differs from rickets and true osteomalacia in that it is relieved by correcting the calcium deficiency. It resembles the above conditions, however, in that the bones are softened and exhibit excentric and spotty atrophy when examined roentgenographically and on microscopic examination are found to contain a variable amount of osteoid tissue, or newly formed and imperfectly calcified bone.

3. The bone atrophies observed in experimental animals and clinical cases with biliary or pancreatic fistulas and in marasmus are similar to hunger atrophy. The bone atrophy occurring in hyperthyroidism has been studied roentgenographically, but relatively little is known as to its cause. It is supposed to be the result of increased metabolism, but muscular weakness may be an important factor.

In adenomas of the parathyroid glands there is an increase in the amount of calcium in the circulating blood, presumably due to an over-abundance of the hormone. The bones being the great calcium reserve of the organism, calcium is withdrawn from the bones and a marked osteoporosis occurs. In

Fig. 9.—Shoulder showing senile atrophy. There is a fracture of the tuberosity.

addition to the generalized osteoporosis, giant-cell tumors and bone cysts occur in these individuals (Figs. 21 and 22).

4. In scorbutus the bones become atrophic largely as a result of cessation in the formation of new bone. The lack of new bone formation is not due to a calcium deficiency or to an absence of osteoblasts, as the blood calcuim is normal and the osteoblasts are more numerous than normal. But apparently the cells are not able to form intercellular material (Wolbach and Howe).[11] It is probable that there is also some disintegration of the organic matrix of the bones with resultant increase in resorption and osteoporosis. This disintegration of formed tissue is especially marked around the teeth and causes them to be loosened. It also affects the blood vessels beneath the periosteum and results in subperiosteal hemorrhages. The condition is promptly cured

by supplying the antiscorbutic vitamine D. Whether or not lack of this vitamine is an important factor in the decay of teeth is a moot question, but Howe[12] and others have produced caries in animals by scorbutic diets and considerable evidence is accumulating which tends to indicate that clinical caries can be controlled by a proper diet.

5. Osteomalacia. This is a condition in which the bones are softened and contain very little mineral matter. True osteomalacia is a rare and poorly understood condition in which there is a negative calcium balance during the active phase of the disease and which is not benefited by a high calcium diet or cod liver oil. It is to be differentiated from the osteoporosis occasionally seen in women who have been on a low calcium diet during pregnancy or lactation.

Fig. 4 shows the tibia of a girl 14 years of age with a condition which might be classed as juvenile osteomalacia. The bones are normal in size but are greatly deformed as a result of bending. The cortex is paper thin and can be cut with a knife. On microscopic examination the cortical bone is found to be honeycombed with large canals, and many of the trabeculae are bordered by a thick zone which stains lightly with hematoxylin and is apparently osteoid tissue. As the osteoid tissue is covered by a layer of osteoblasts and there is abundant evidence that lacunar resorption by osteoclasts is in progress (Fig. 5), it seems probable that this is newly formed bone matrix which is incompletely calcified, rather than true halisteresis.

6. Rickets is also a condition in which the bones are softened and in extreme cases can be cut with a knife. It differs from true osteomalacia in that it affects only growing bones and can be readily cured by an adequate diet plus vitamine D from cod liver oil or sunlight. The softened bones may develop severe deformities from static influences or muscle pull, and these deformities often persist after the disease has healed. In addition to the obvious deformities of the extremities which occur in rickets, it is probable that many of the cases of malocclusion are the result of rachitic softening of the jaws.

Pathologically rachitic bones are characterized by marked broadening and irregularity of the epiphyseal line and by generalized osteoporosis and osteoid tissue. The lack of calcium in the bones is not due to deficiency of osteoblasts, as these are abundant in rachitic bone and are quite capable of laying down calcium if it be supplied to them, as has been shown by Shipley, Kramer and Howland[13] who placed rachitic bones in normal serum and obtained calcification in vitro. The fault then is obviously an abnormally low concentration of calcium or phosphorus in the serum, and this has been shown to be the result of deficiency of the vitamine D, but the exact mechanism of the working of the vitamine is still obscure.

The osteoporosis of rachitic bones is largely the result of lacunar resorption by osteoclasts. Whether or not this resorption is accelerated or simply proceeds at the normal rate for the child and the resultant osteoporosis is due to the lack of new bone formation, is not definitely known. Likewise we have no definite knowledge as to the occurrence of halisteresis in rachitic bone. We know that much of the osteoid tissue is newly formed matrix which has not been calcified, but many observers claim that part of the calcium is dis-

solved out of the previously normal bone and the matrix is left intact. The bending which occurs in rachitic and osteomalacic bones is suggestive of true halisteresis because in extreme senile osteoporosis the bones are easily broken but do not bend.

LOCAL BONE ATROPHY AND RESORPTION

1. Atrophy of disuse: Generally speaking, increased activity and function within physiologic limits alternating with periods of rest tend to cause an increase in the size and function of an organ, while inactivity and in certain instances overactivity result in atrophy. This is true of bones as well as of

Fig. 10.—Atrophy caused from disuse due to immobilization. In cast for five months following a fracture of the leg.

more highly specialized tissues such as glands and muscles, and in bones the function may be said to be passive in character since it consists of resisting mechanical forces. Consequently if a bone be removed from the necessity of resisting mechanical forces we may expect atrophy (Figs. 10 and 11).

It has been shown that so far as the effect upon the bone is concerned it makes practically no difference whether the inactivity is due to enforced rest by means of plaster of Paris casts or muscle paralysis, and that the presence or absence of sensory nerves to the part is of no importance (Grey and Carr[14] and Allison and Brooks[15]).

The pathologic picture presented by bone which has undergone atrophy of disuse is well known and has been described briefly under the characteristics of atrophic bone, and it is fairly well established that the process is one in which the physiologic resorption proceeds at the normal rate while the normal bone formation is decreased or abolished. It is further believed that the resorption is largely if not entirely due to the activity of osteoclasts (Fig. 12). But we have as yet no satisfactory explanation as to how inactivity causes atrophy.

According to Weigert functional activity is always detrimentally opposed to nutrition and formation and results in a destruction of the living part

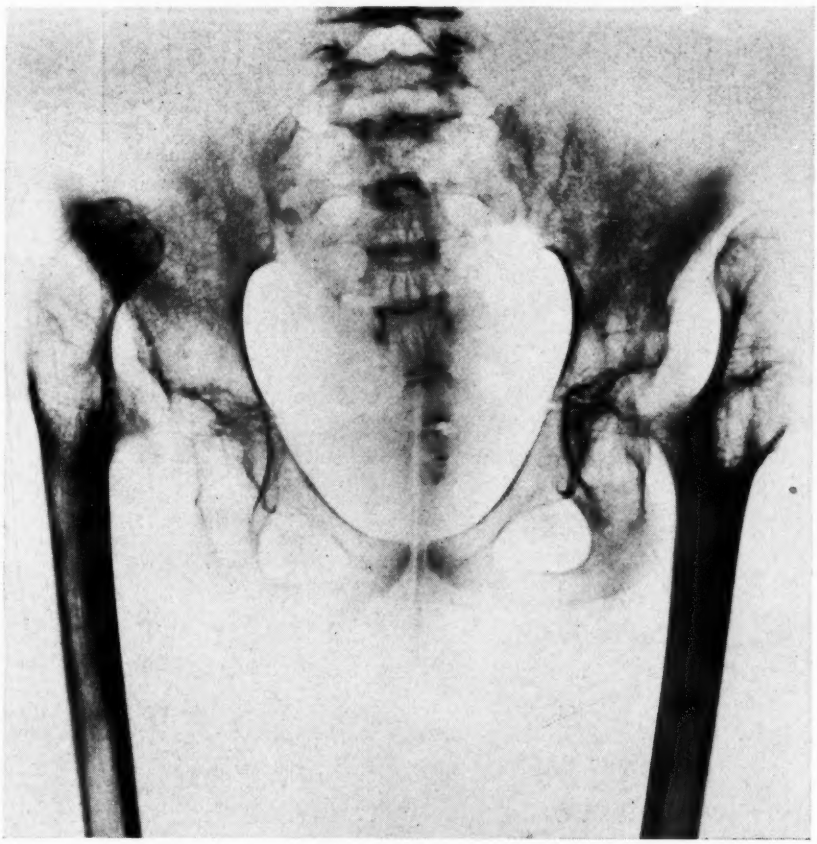

Fig. 11.—Congenital dislocation of the hip after bifurcation. Operation. Note extreme atrophy of upper ends of the femora due to lack of function after the operation.

which is renewed by nutritive and formative activity. In bones inactivity causes the osteoblasts to reach the same condition which they attain in senility, and they are unable to replace the bone destroyed by the osteoclasts which are not affected by the process.

Even if we grant the above hypothetic explanation we are still confronted with the curious fact that these apparently senile osteoblasts become rejuvenated and begin to lay down bone as soon as the atrophic bone is subjected to mechanical forces.

There are many other theories which attempt to explain the phenomenon, but none of them seem adequate. A very widespread theory is that the atro-

phy is the result of circulatory change in the bone, but we do not even know whether the circulation is increased or decreased in atrophic bone, and Pommer[16] believes that the atrophy is due to increased circulation while Leriche treats bone atrophy by periarterial sympathectomy which is supposed to cause increased circulation. So we have a great deal to learn on the sub-

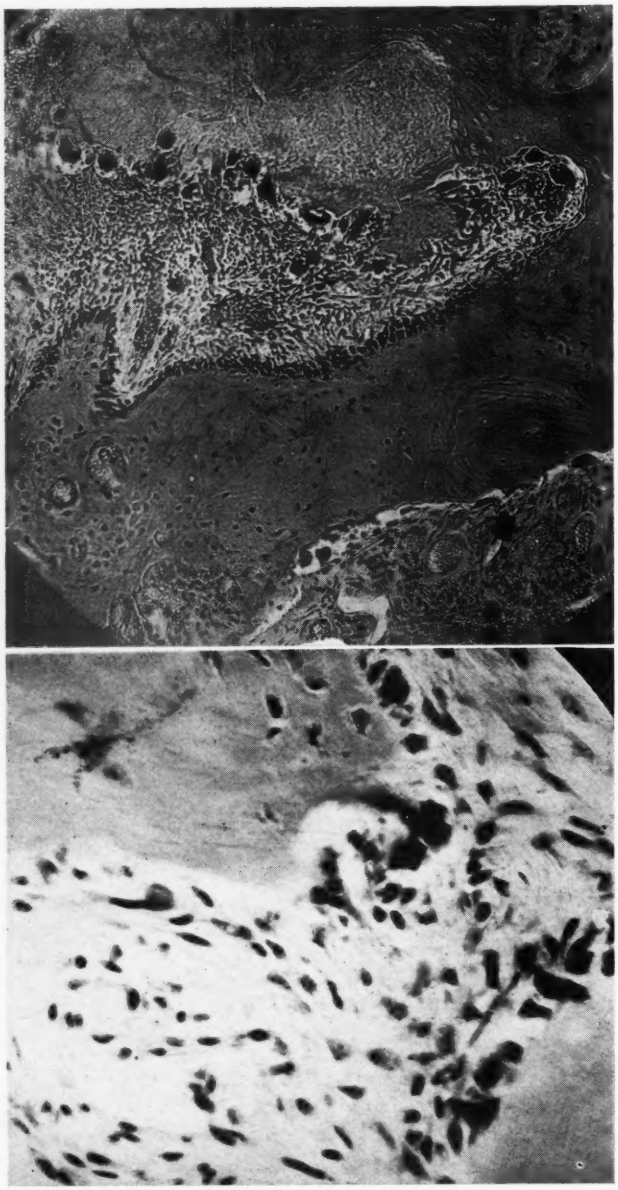

Fig. 12.—Slipped epiphysis of the femur. Upper section shows absorption of devitalized bone by osteoclasts and osteoblastic bone formation just below. Lower section shows osteoclasts eroding bone.

ject of simple bone atrophy, and it is not yet possible to offer any adequate explanation of the phenomenon.

2. Acute traumatic bone atrophy: This is a curious condition which is usually called Sudeck's atrophy because it was first described by him (Sudeck[17]). It is of rather frequent occurrence, but a surprisingly large

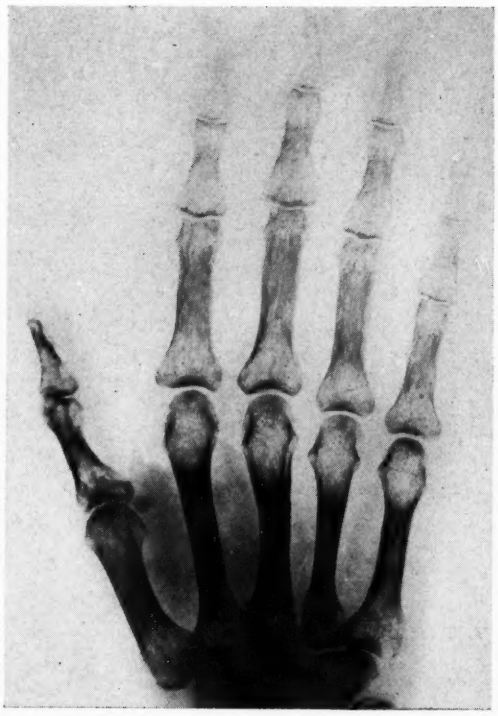

Fig. 13.—Sudeck's acute atrophy of the hand, four weeks after fracture of the elbow.

Fig. 14.—Sudeck's acute atrophy of the foot, four months after an injury to the knee. There has been no immobilization at any time.

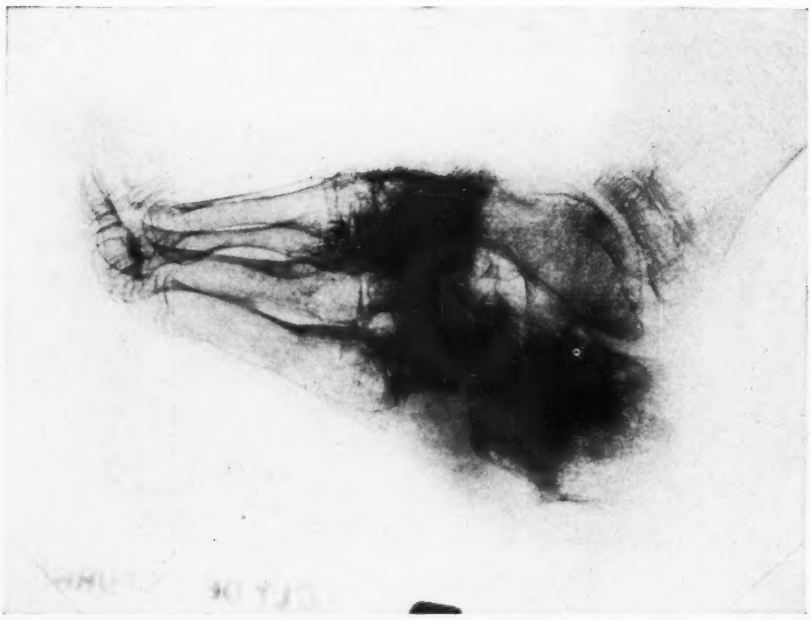

Fig. 15.—Extreme atrophy of the foot due to postoperative infection. The dense areas are due to new bone formation.

Fig. 16.—Cross-section of rabbit's femur showing extreme atrophy due to osteoblasts and subperiosteal proliferation of fibroblasts following pyogenic infection of the knee joint.

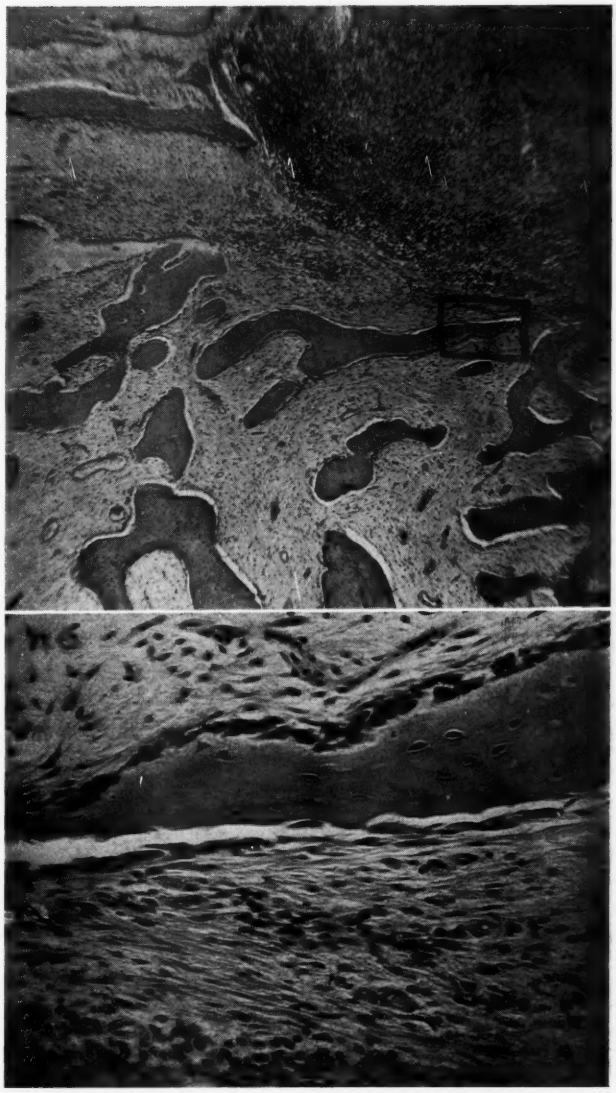

Fig. 17.—Osteomyelitis of the tibia showing abscess formation above and new bone below. Lower section shows higher-power view of new bone spicule in rectangle. Next to the abscess it is being absorbed by flattened osteoclasts, while above new bone is being formed by osteoblasts.

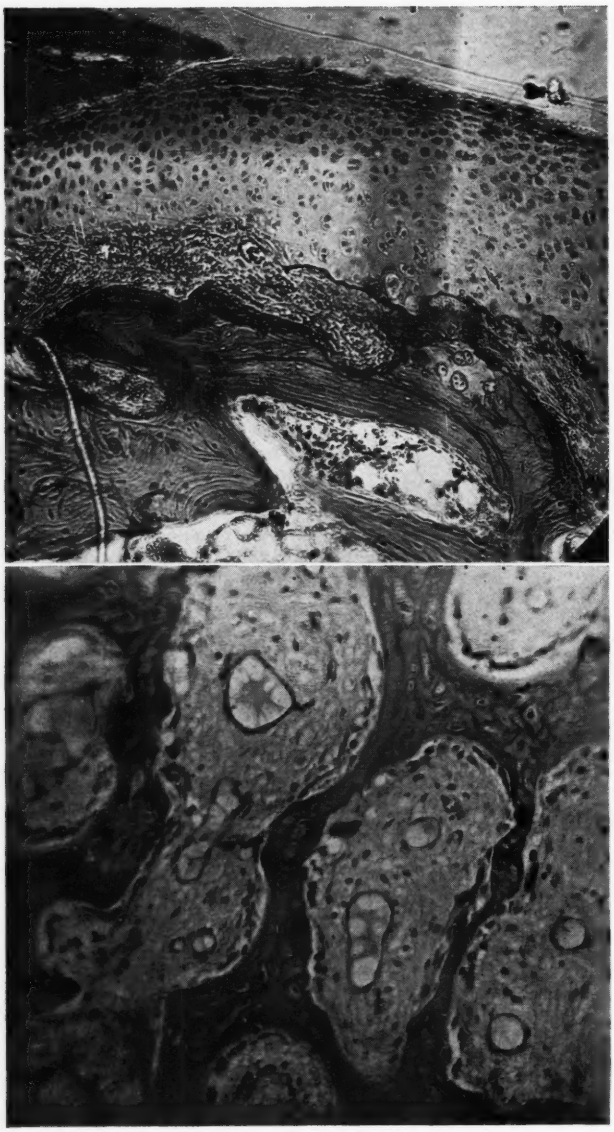

Fig. 18.—Inflammatory bone absorption above in a case of tuberculosis of the knee showing invasion of subchondral zone by vascular granulation tissue. Below is osteoclastic resorption of trabeculae in new bone formation around an osteomyelitic focus.

number of well-informed surgeons are either ignorant of the condition or skeptical of its existence.

Sudeck's atrophy is a rapidly progressing osteoporosis which involves the bones of an extremity which has been subjected to trauma. This may have been a severe injury or only a rather trivial sprain or contusion. After the injury the parts distal to it remain swollen, tender, cold, and cyanotic, and the surgeon is at a loss to explain the failure of restoration of function. If an x-ray is taken, it will be found that the bones show marked osteoporosis

Fig. 19.—Fibrocystic disease of the tibia (postoperative) showing marked bone resorption.

which may be spotty in character, and this atrophy and loss of function may persist over a period of many months (Figs. 13 and 14).

A discussion of the various theories regarding this acute posttraumatic atrophy is given by Beck.[18] Sudeck regarded it as a reflex neurotrophic phenomenon, but as yet we have no satisfactory explanation of the condition. It is quite possible that the root absorptions occasionally noted after orthodontic procedures are a form of this condition.

3. Atrophy accompanying local inflammation: Most surgeons who are interested in the surgery of the extremities have been impressed by the rapid

and often severe osteoporosis which occurs in the vicinity of infections. This bone atrophy has long been stressed in joint tuberculosis and is regarded as one of the earliest roentgenographic signs of the disease. It is also a constant finding in pyogenic infections which have persisted over a sufficient period of time (Fig. 15), though here the resorption of bone is often obscured by the production of new bone and is consequently given less prominence in the literature on the subject.

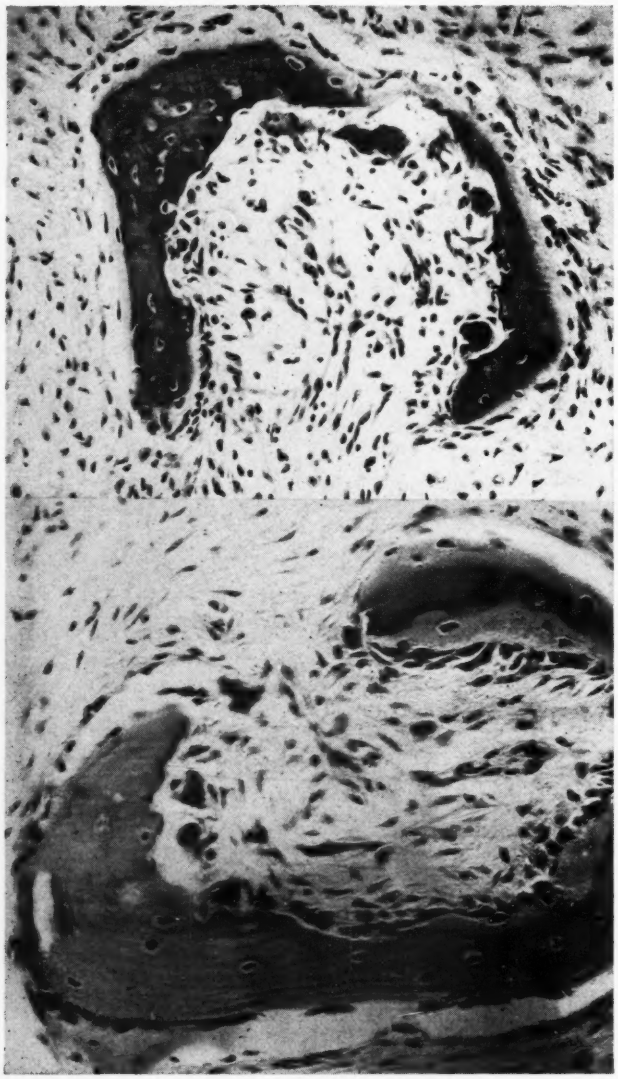

Fig. 20.—Sections of bone shown in Fig. 19. Both pictures show osteoclastic resorption of hollowed out trabeculae and some osteoid tissue which is apparently being formed by osteoblasts.

The atrophy is, of course, in part due to the disuse incident to the infection, but like Sudeck's atrophy it progresses more rapidly than does simple atrophy of disuse, and there appears to be a definite increase in the rate of resorption both in the diseased area and in the adjacent bone. Whether or not the local increase in the circulation incident to the infection is an important factor in the osteoporosis is a moot question. In the bone which is re-

moved from direct contact with the infected tissue the resorption appears to be chiefly of the lacunar type and the result of an increase in the number of osteoclasts in the tissue. An example of marked osteoclastic resorption is shown in Fig. 16. The knee joint had been infected with staphylococci twelve days before, but the section is from the cortex of the femur above the diseased area. Whether or not the unusually large number of fibroblast-like cells which fill the space between the periosteum and the bone are also partly responsible for the resorption is not known.

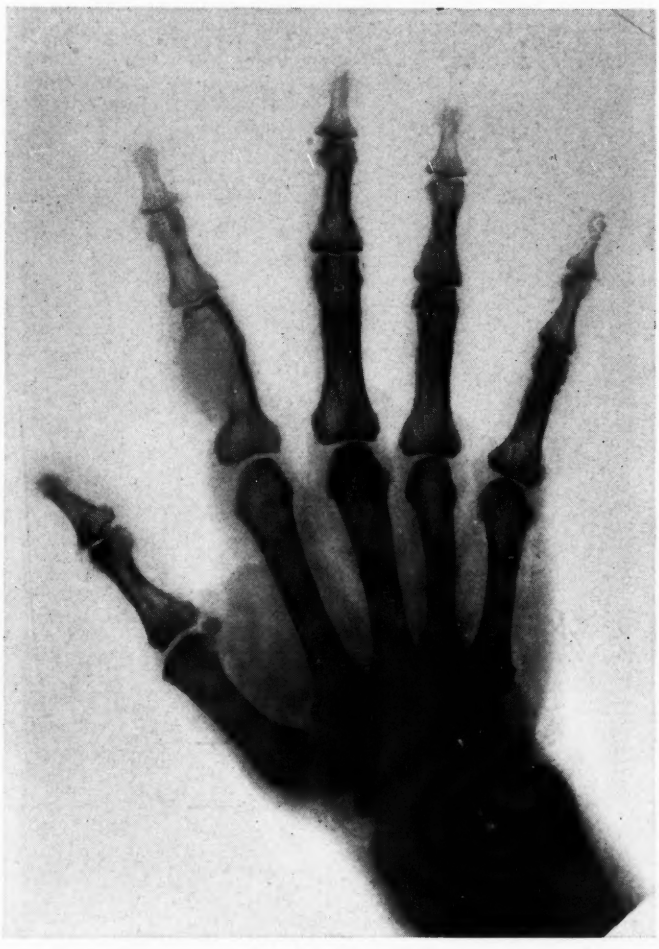

Fig. 21.—Giant-cell tumor of the first phalanx of the index finger. Note lace-like structure and fuzzy borders of all the bones. This patient had a parathyroid tumor.

In areas adjacent to the disease there may occur simultaneous resorption and new bone formation (Fig. 17), and here the resorption is partly by osteoclasts and partly by vascular granulation tissue. In the bone spicule illustrated in Fig. 17 the side next to the abscess is in process of resorption while new bone formation appears to be going on on the other side. In Fig. 18 both sides of the lamellae are apparently being absorbed by osteoclasts, while in the specimen from a rabbit's knee infected with tubercle bacilli the subchondral resorption appears to be entirely due to the vascular granulation tissue. However, osteoclasts are present in other parts of the section, and

these cells play an important rôle in the osteoporosis due to joint tuberculosis.

The osteoporotic changes due to syphilis and other infections and to burns, freezing, and chemical irritants are similar to those occurring in the infections mentioned above.

4. Pressure atrophy: This form of bone atrophy has been discussed rather briefly in a previous section, but sufficiently, I hope, to leave the impression that there is still much to be learned about this phase of the subject. It seems to me that resorption of bone from pressure is one of the fundamental principles of orthodontia and that it will be from workers in this field that much of our knowledge of the subject will come. For instance when a tooth

Fig. 22.—Cross-section of cortex of the middle phalanx of the ring finger shown in Fig. 21. Note marked bone absorption.

is moved from A to B the intervening bone is not bent or pushed aside, but disappears as a result of abnormal pressure. Clinically much can be learned regarding the differences between the responses of growing and adult bone to pressure, while experimentally a wide field is waiting for those who choose to work with experimental animals and study the material after various orthodontic procedures on the teeth.

5. Neoplastic resorption: As is well known, bone cysts, fibrocystic disease, and benign and malignant tumors cause the disappearance of bone which is in their line of growth. In bone cysts the resorption is apparently due to osteoclasts, and the same is true of fibrocystic disease (Figs. 19 and 20). But it is

quite possible that the fibroblast-like cells may be responsible for much of the damage to the bone, just as they appear to be in the giant-cell tumors and in the malignant tumors. In Fig. 23 the small spicule of bone is apparently being eroded by the fibroblast-like cells while the giant cells which are very numerous in the tumor seem to be accountable for very little of the erosion of bone.

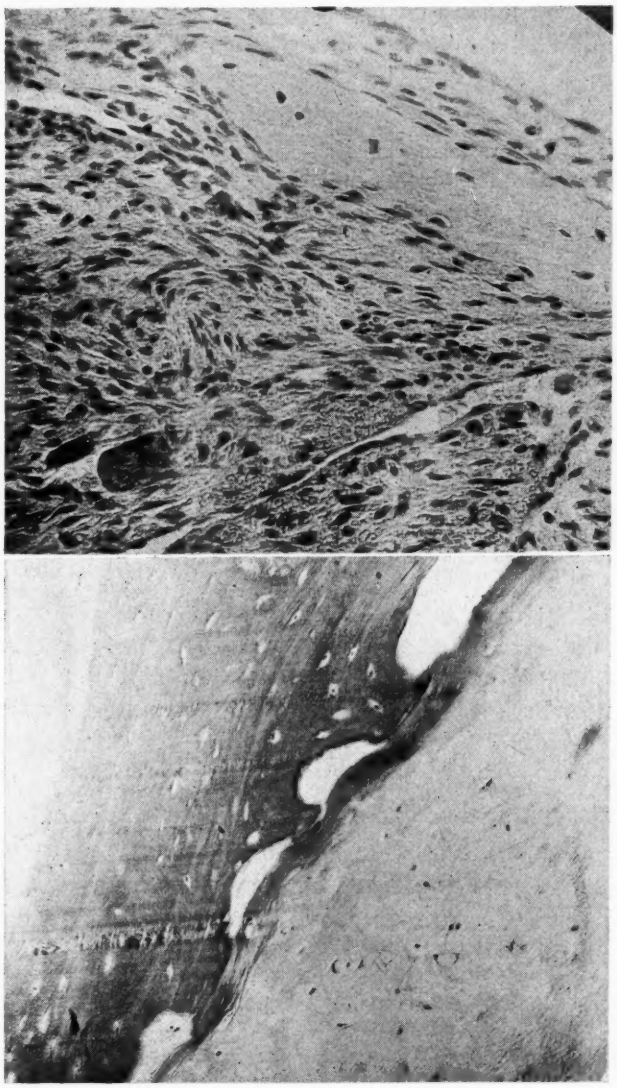

Fig. 23.—Resorption of bone by tumors. Above, edge of tumor shown in Fig. 21, showing absorption of bone by fibroblast-like cells of the tumor. Below, an enchondroma eroding three bone trabeculae.

It is often stated that growth pressure is the chief factor in the erosion of bone by cysts and tumors, but I believe that the tumor cells themselves possess the power of dissolving the adjacent bone without any evidence of phagocytosis or even of direct contact with the tumor cells. In Fig. 23 a rather soft cartilaginous tumor is growing toward the bone on the left and has almost reached it. The stumps of three lamellae are projecting from the

bone, and the main portions of these appear simply to have melted away before the advancing tumor, and this with so little resistance that their sharp points have scarcely indented its surface. A close study of the section reveals not a single cartilage tumor cell in direct contact with the bone. Is this pressure or is it chemical action?

6. Neurotrophic disturbances of bone: Charcot joints are conditions in which the adjacent surfaces of the bones literally disintegrate and gradually disappear. At times the change is accompanied by a variable amount of new bone formation, and this may be excessive. As was stated above the condition occurs in tabes dorsalis and syringomyelia and is believed to be due to the destruction of some of the sensory nerves to the parts. Furthermore, it has been produced experimentally by sectioning the posterior spinal nerve roots in cats.

There is no preceding or accompanying osteoporosis in these bones other than what one would expect from disuse or senility, and at times they even appear to contain more calcium than normal. Apparently the disintegration is due to some as yet unknown change in the organic matrix which causes the bone to lose its toughness and elasticity.

SUMMARY

Bone atrophy may be due to congenital hypoplasia or to postnatal influences which retard development or cause a decrease in the mineral content of normal bone. Bone is a very labile tissue, and the maintenance of normal volume, density, and architecture is the result of a delicate balance between constant resorption and deposition of new bone. Atrophy results from excess resorption.

Of the various methods by which bone resorption is theoretically possible, the erosion of bone by living cells is the only method which is generally accepted. It is probable that the organic matrix is changed in certain neurotrophic disturbances, and it is possible that true halisteresis may occur under certain pathologic conditions. It should be mentioned that the chemistry of the inorganic constituents of bone does not change with atrophy, and this is purely a quantitative and not a qualitative change.

It is shown that pressure may cause bone resorption or deposition and that we know relatively little about the manner in which pressure exerts an influence upon bone.

The characteristics of atrophic bone are given and the special types of general and local atrophy and absorption are described.

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DISCUSSION OF PAPERS BY DR. J. ALBERT KEY AND DR. McKIM MARRIOTT*

Dr. John A. Marshall.—In approaching the study of any question it is always well to get the historical background. At this moment we are asking ourselves what is the significance of an improper diet. Its significance can be easily traced. One of the earlier Greek philosophers who despaired of mankind was born B. C. 430—Heraclitus. At the height of his despair he retired to the mountain fastnesses and lived on vegetables and herbs; as a result of such fodder he became dropsical and died.

This, an individual experience, grew to be a national one on several occasions in France, and each time it was due to restriction in food, both as to choice and amount. In A. D., 586, 1817, and 1870 were famines in France which followed a diet largely vegetarian in character. In the world war the undernutrition which developed arose from the fact that the foods had a high water content, an absence of fat and too little sugar.

Some of the chemical symptoms of undernutrition are first that muscular fatigue is more quickly produced, and second the love of sport and of pastime wanes. All possible bodily exertion is avoided. There is an apathy in mental work; the personal initiative, the power of performance and the love of accomplishment are lacking.

The usual energy requirement was estimated by Rubner to be 2569 calories and 91 grams of protein. The changes in protein which occur in the body are exceedingly complex and highly important to the individual animal. Lusk has aptly stated that, "The functional activity of living matter is *primarily* due to the arrangement of protein in the protoplasm."

Protein, like all the other dietary elements, suffers daily losses, "such as 'wear and tear' produced by growth of hair, nails and epithelia; it includes as well the losses through digestive juices, and in short through the functional activity of all the organs and tissues of the body." This is especially true of the daily destruction of the blood proteins. This wear and tear has been definitely calculated by Rubner to be 3 grams of nitrogen per day. There is an inevitable loss of 0.14 per cent of total body protein daily unless it is furnished by the diet.

Of no less importance is the energy metabolism. The dictum of Carl Voit is to the effect that the average laborer requires 3000 calories daily. But the experiences of the war raised this amount to 3,300. In certain prison camps Mueller stated that as a result of the restricted diet all the inmates were dead, which is one way of saying that the energy metabolism cannot be reduced to a point of emaciation, nor can the protein intake suffer too rigid a restriction.

Energy metabolism is linked up with the *intake* and *elimination* of both the fats and the carbohydrates. The true energy requirement also takes into account a part of the protein

*See page 835, September issue.

molecule. There are abundant data to prove that the well-nourished individual feels a zest for his work, but the undernourished one avoids labor instinctively. "Walking gives no pleasure to the underfed seamstress, nor golf to the half-starved college professor." In this connection it may be recalled that emaciation may alter the position of the various viscera not only through a reduction in the normal amount of peritoneal fat which serves to maintain their position, but also through a reduction in the size of the organs themselves.

It is well known that the undernourished individual is much more susceptible to the sensation of cold as well as to the various forms of symptom complexes grouped under the term "common cold." One reason for this is that the heat production by the body is subnormal.

But, one of the most outstanding contributions to the science of nutrition is linked with the McCollum group at Johns Hopkins, and Osborn and Mendel at Yale.

The national experience in Denmark with the undernourished children is one in which a catastrophy was barely averted. Due to the inaccessibility at the time of the American literature on the subject, the prevailing opinion in the blockaded countries was to the effect that fats could be dispensed with in the diet. Consequently the Danish children suffered, and as Block has pointed out they wouldn't eat because they had no appetite. They were underfed, undernourished, and in general were in poor physical condition. All of this was cured by rationing butter, whole milk and cod liver oil. Even the concomitant xeropthalmia was cured except where the condition had proceeded so far as to destroy the eyesight.

In this country fortunately we face no such national calamity as did Denmark in 1917. We recognize the relatively high incidence of rickets among certain classes in our population and in certain areas. But aside from this there is, I believe, no one condition conspicuously responsible for infant mortality or delayed physical development which is described throughout the country and affecting the children from parents in all walks of life.

The aspect of the nutrition problem confronting the orthodontist is this, what can be done for the patient who doesn't respond to treatment? Naturally the first line of attack is the general health of the individual, a question which, may I point out, the orthodontist is not qualified to settle. That decision rests with the physician. That malnutrition is a responsible factor in failure of certain cases cannot be denied. But with the change of diet or of environment, it is folly to expect immediate improvement or a cure overnight. There is only one thing worse than an impatient patient, and that is an impatient doctor, be he physician or dentist.

The laboratory has contributed its share of experience in determining certain procedures for clinic trial. And it is sometimes difficult to correlate the two fields. Eventually, however, such a correlation must be made. For example, the knowledge of mineral balance in body between calcium and phosphorus, as discussed by Doctor Marriott, and between sodium and potassium and calcium was derived, in part, from the classical experiments of Jacques Loeb and earlier from those of Ringer. Both of these scientists working from different directions arrived at the same point and proved that a lack of one of the mineral elements in the body or rather of a lower amount of one, may produce toxic results comparable to those arising from too great an amount of an element.

Hereditary influences and environmental factors have been useful phrases for both pathologist and surgeon almost from time immemorial. They are so all-embracing. They include with equal force either the pathologic anlage or the acquired type of lesion.

The factors responsible for the malfunction of cells in the early life of the embryo have been deeply studied and have been the cause of much speculation. Some curious theories have been discussed in the past so that now "one views with alarm," so to speak, those writings which are too enthusiastically concerned with hereditary influences. Perhaps this much may be said that the previous history of the parents and earlier forebears is linked very closely with the changes incident either to normal or to pathologic osteogenesis. The connective tissues as well as the connective tissue forming cells seem susceptible to malnutrition, especially the fibroblasts, osteoblasts, and odontoblasts. In fact osteoblast and odontoblast are closely related as to both origin and function. Both are derived indirectly from the mesoderm. Both require a fibrous matrix on which to work; both build hard tissue which is more dissimilar in histologic characteristics than in chemical composition.

It is fair to assume, therefore, that they may respond to the same stimuli or be affected by similar influences. If this is true, one may expect to find in the case of poorly formed bone, as for example rachitic bone, an interference also in the formation of the dentin. And this is indeed the case. However, I am of the opinion that Mellanby and Pattison did not eliminate all the disturbing influences in their experiment upon feeding children. In the first place, if my memory serves me correctly, the patients were all tuberculous. This introduces the query, what dental application can be made of an experiment of approximately six months' duration on unhealthy subjects? And, furthermore, is one justified in basing conclusions on experimental results obtained during this relatively short period of time, without taking into consideration the individual's previous environment and state of health? It will be recalled that these children were tuberculous, and it has been established that calcium metabolism in tuberculosis is abnormal. The influence, therefore, which bone tuberculosis may have on the whole phenomenon of calcium absorption and bone growth is difficult at this time to determine, especially in so far as tooth formation is concerned.

An especially interesting communication by Macomber of Harvard sheds additional light on this point. His work dealt with diets deficient in lime instead of vitamines, and he clearly points out that "Calcium is the most important of the inorganic elements in the animal body. In the adult, it furnishes two per cent of the total weight, and ninety-nine per cent of this is found in bones and teeth. It is present in all tissues including the blood, and without it life as we know it would be impossible." Macomber's experiments have a particular dental application, for he reports likewise that the molar teeth of the rat are decalcified and become carious as a result of calcium-deficient diets, which is in some respects a confirmation of my own results.

The rat is, as you know, monophyodont, but nevertheless is provided with two types of teeth. The incisors constantly erupt throughout life and grow from a persistent pulp; the three molars, upper and lower, right and left, do not. Only the molars are affected by these deficient diets. A close laboratory record has been kept in an experiment now being conducted of all these animals from birth to death, this record including the date of birth, the parentage, and in many cases a greater part of the geneologic tree. In addition, there is also a report of the first clinical evidences of avitaminosis—scraggly hair, development of corneal ulcers and lingual abscesses, and decreases in growth weights and so on.

So far the research has shown that the molar teeth develop carious lesions as a result of an imposed diet deficient in vitamine A. This may be due to abnormalities in the formation of the teeth, or to a subsequent decalcification from the pulp outward.

The union between the organic and inorganic constituents of bone is very intimate; but, as Doctor Key has pointed out, there is no evidence as yet of an actual chemical union. However, in dentin the case is different, for there has been presented evidence of existence of a compound which apparently contains in chemical combination both the phosphate and the carbonate of calcium united with a globulin.

The resorptive processes in bone appear to be dependent upon an osteoclastic action in which the eventual solution of the organic bone matrix sets free the calcium compounds. These are later carried away by the circulatory system. In the resorption of teeth a similar process occurs which has been demonstrated as a normal one in the case of the shedding of deciduous teeth. Not only the modified osteoclasts, which in this case are designated as cementoclasts function, but also another group of cells aid in hastening the resorption. These are the modified odontoblasts which are termed for convenience odontoclasts. In cases of uninfected pulps in deciduous teeth the odontoclasts aid in the process of shedding of the teeth, but when pulp infection exists or pulp death has occurred, the burden of resorption is carried solely by the cementoclasts. In either case, however, the serrated edges of the structure undergoing resorption are entirely comparable to those described by Doctor Key in bone.

Depending upon the amount of pressure exerted there may be hypertrophy or absorption of bone, and it is this undetermined balance of pressure which perhaps is concerned with the absorption of tooth roots. In the case of undernourished children, may we not assume that bone already atrophic is more susceptible to absorption than otherwise? And furthermore that

when additional trauma is produced from the unwise application of stress from orthodontic bands further degenerative changes occur? The field is already prepared, so to speak, for more profound pathologic changes.

There is one point in Doctor Marriott's paper which we might also discuss. It deals with the embryology of the tooth. From my recollection of embryology, only the enamel arises from the epiblast. The other dental tissues come from the mesoblast in common with the other connective tissues of the body.

It has been a privilege to listen to the papers of Doctor Marriott and of Doctor Key, and an honor to be asked to discuss them.

Dr. Henry F. Hoffman, Denver, Colo.—It is a wonderful privilege to hear this paper and an even greater privilege to read it carefully, for only so can its full value be adequately appreciated.

Since the correction of malocclusion and the permanency of the correction are largely dependent upon bone growth and tooth development, we, as orthodontists, should be interested in the factors influencing these.

In this consideration the importance placed upon nutrition by the essayist is indicated by his including "inadequate nutrition" along with heredity, endocrine disturbances and bacterial invasion as a frequent cause of deformities and structural defects, with which he must include deformities and structural defects of the teeth.

It is doubtless true, as the essayist claims, that diet is more effective than cleanliness in the control of caries; however, in orthodontia practice we deal with teeth defective in structure and with patients indulging in incorrect diets. For their protection as well as for our own we are obliged to render them every possible service for protection during orthodontic treatment, which means that we should stress equally nutrition and cleanliness.

The essayist makes the point that the greatest value in rough foods is in the increased flow of saliva and the development of the bones through muscular activity.

Dr. Marriott says, "The fetus suffers less than the mother from deficiencies in the diet," still I think that perfect development cannot be expected when there has been any considerable deficiency in the diet of the mother. We do not know just how far these deficiencies can be compensated for from the mother's system.

Even allowing for changes in the enamel as a result of changes in the nutrition or metabolism of the individual, we recognize that enamel of the teeth after being formed is influenced subsequently far less than any other tissue of the body; therefore perfect development of the structure of the enamel is possibly of greater importance than the perfect development of any other organ or tissue of the body.

The possibility of subsequent repair is almost nil; consequently, as the development of enamel begins in intrauterine life, the importance of absolutely perfect nutrition during this period is apparent.

Concerning the subject of rickets, the essayist calls our attention to the fact that rickets only develops in rapidly growing children, and that the most frequent cause of rickets is neither a deficiency nor an excess of calcium and phosphorus in the diet but a lack of vitamine D, the only vitamine known to be synthesized in the body by sunlight, and that the same type of dietary deficiencies which leads to rickets also leads to changes in the teeth.

Speaking of the "typical rachitic hypoplasia" showing in the four incisors, the tips of the canines and crowns of the first molars, he says, "The central incisors show defects of enamel which are greater than that of the other incisors." The difference in the defects occurring in the different teeth only indicates what portions of the different teeth were being formed at the time the deficiency occurred.

He goes on to say that, "The correction of dietary faults during the developmental period leads to recalcification and improvement in the structure of the teeth."

If by the term "recalcification" is meant a further deposit of enamel where there was a deficiency due to any interference, we know that that cannot take place, for the enamel forming organ is no longer operative at that point. Recalcification may take place in the bones, and an increase in the density of the dentine and further deposits of dentine, and possibly some increase in the density of enamel, but there is no change in the amount or form of the enamel.

His point that cod liver oil or "Viosterol" should be of value in influencing rapid calcification after movement of the teeth is of special interest to us and presents an opportunity for the research worker to give us some very practical assistance in determining what time during orthodontic treatment increase in calcification is desirable and if root resorption in permanent teeth can be controlled by this means. Also it brings up the very vital question of whether, by modification of the calcium phosphorus content of the bones, we can so soften the bones of some of our patients as to render tooth movement practicable.

In conclusion I want to ask, what are we to do about it? The essayist makes the statement that, "A diet to be most effective in bringing about calcification in the bones should be one containing adequate and balanced amounts of calcium and phosphate and in addition, vitamine D." These directions may sound simple, but to administer them is quite another matter.

Prescribing diets, although often necessary, is generally considered outside our field. Excepting those cases which are subjects for the pediatrician and which can successfully be referred, there is almost never, I might say never, any hope of relief through the general medical practitioner. The medical and dental professions are largely in the same repair rut. Outside of the specialty of pediatrics and with the exception of a few isolated instances, the medical profession is neither inclined nor educated to meet the problem of nutrition for proper development, for the maintenance of health, or for the cure of disease.

There is a great need for a radical change in the education of the physician if the medical profession is to meet fully the demands of a mentally developing public. This hope is now centered in the specialty of pediatrics, about the only branch of medicine which offers service for proper development of the individual and for the maintenance of health as paramount to the cure of disease.

If this need is not met by the medical profession, then it is up to us to make nutrition in the orthodontic curriculum of equal importance to that of mechanics.

Again I want to thank the essayist for this excellent paper, for giving us such an understandable, thorough, comprehensive and sane presentation of this subject which is of such importance to the orthodontist.

Dr. W. O. Colburn, Lincoln, Neb.—I was especially interested in Dr. Marriott's talk on the vitamine balance. We now have vitamine D in almost pure form which would seem to supply the calcium that we need, but it is necessary also to have some other vitamines associated, as he suggested, vitamines A and C. Milk is a well-balanced food and is almost a perfect food, but it is necessary, allowing that as about fifty per cent of our diet, that we have other foods to make up the balance.

I have used ergosterol preparations for the last year or fifteen months very satisfactorily, I thought, but I should like to ask Dr. Marriott if he would prefer—if the patient were willing to take it—the old-fashioned cod liver oil in which there are vitamines A and D.

I am still somewhat skeptical whether we have had the last word on rickets in that we have our vitamines, sunlight, and so forth. From that standpoint I should like to hear what Dr. Marriott would have to say.

I certainly don't want to take up any of your valuable time. Thank you. (Applause.)

Dr. H. L. Morehouse, Spokane, Wash.—I should like to ask Dr. Marriott a question that has come to my mind and has been called to my attention a great many times. We have trouble with the obstetricians and the physicians in the diet they prescribe for the mother, since they recommend a diet that will produce a flexible pelvic region for delivery. How are we going to get the proper diet, the calcium for developing the fetus, the teeth, and at the same time keep a flexible pelvic region?

Dr. Martin Dewey, New York City.—In listening to Dr. Marriott's paper—in fact, it is true of all these men on nutrition—I am reminded of card experts. They will deal cards out here in front of you and think they are very wonderful, but the first thing you know they slip one from the bottom. (Laughter.)

I refer particularly to some statements Dr. Marriott made, the first one of which was that a child would be as perfectly healthy and well nourished on artificial diet as he would on a good normal diet. That seems very illogical, and it cannot be proved. It is one

of those things that is disputable. You can't prove it, because if a child is raised on an artificial diet, it can't be raised on a natural diet. From what we know about balanced diet, it seems improbable and impossible to conceive that a well-balanced diet, as natural as the mother's milk, could ever be supplied artificially.

Another statement which he made was in regard to the test tube experiment where he had produced bone, so far as chemical composition was concerned, artificially. He didn't produce bone at all, because bone is not a chemical substance alone. Bone is a histologic substance. Bone is developed and is not deposited. He talked about the deposition of bone. Dr. Key talked about the development of bone. It is development not deposition. Get the idea out of your head that bone is deposited. All Dr. Marriott found in his test tube was a chemical substance which seemed to have the same chemical composition as bone. It was not bone.

Moreover, he made the statement that the slogan, "A clean tooth never decays," should be changed to "A well-nourished tooth never decays." I heard considerable applause from the audience, which reminded me of the fellow who votes dry and drinks wet. You know as well as I, from practical experience, that a tooth that is not clean will decay. You know you have to cement your bands on. If a band comes loose, that particular tooth is going to decay. That tooth is just as well nourished as the rest of them that do not decay. That a well-nourished tooth never decays is the most idiotic and foolish thing that has ever been advanced, and Dr. Marriott is not the only man who is saying it today. I have the same trouble with other friends who consider that Miller's acid decay is wrong because they subject experimental animals to a diet of sugar and starch and the teeth do not decay. That experiment goes on for a few months only.

Furthermore neither Miller nor anybody else ever said that acid bacteria was the sole cause of the decay of teeth, or so-called caries. You have a mucoid plaque, and that mucoid plaque develops more readily in the mouth of an individual improperly nourished; therefore, the teeth are more apt to decay in the poorly nourished patient than in the well nourished.

Dr. Marriott referred to a cavity filled with acidophilus and sugar, and sealed shut. Sugar itself doesn't produce caries. However, a diet which contains much sugar is most liable to allow the formation of the mucoid plaques, and under those plaques the caries takes place.

Furthermore, we find our nutritional friends going off on another tangent. They talk about decay occurring within. I am glad my friend, Hoffman, spiked that argument. Enamel is not nourished after once formed. It is true that Sherman Davis and others cite the fact that where patients have white spots and the diet is changed, the white spots disappear. We will admit that. They do not disappear because of nutrition; they disappear because of the changed condition of the saliva. You can take an extracted tooth and subject it to acid, fruit acid, lemon juice, and the enamel becomes soft and you can cut it with a knife. But when placed in another composition which contains more calcium, the white spot disappears and the enamel gets hard. Nobody will get foolish enough to say the enamel of an extracted tooth is nourished. These changes that occur in the enamel are not changes due to nutrition. They are changes as a result of the environment in which the tooth is placed. (Applause.)

Dr. McKim Marriott, St. Louis, Mo.—I wish to thank those who have discussed the paper for their very illuminating discussions. It was worth coming to this meeting just to hear the discussions.

I quite agree that there are no changes that take place in the enamel once it has developed. I have never seen any changes occur in the enamel as the result of diet. However, there are changes which may occur in the dentine, as Dr. Hoffman has pointed out.

There are a number of other points in the relation of nutrition to teeth that might have been discussed had the time been longer. The ductless glands influence nutrition, and also the development of the teeth.

In thyroid deficiency there is delayed dentition and faulty structure of the teeth, and in that condition the feeding of thyroid will help. The thyroid gland, however, is the only ductless gland which when fed by mouth has any effect. All the other shotgun gland mixtures are just about as good as so much milk sugar or bread crumbs when fed by mouth.

The parathyroid may be deficient and affect the teeth. There are also very marked changes in the bones and teeth when there is too much parathyroid.

One of the cases that Dr. Key showed you is one that I happened to have seen where there was too much parathyroid gland, and that caused a general destruction of the bones throughout the body.

There is a parathyroid preparation (parathormone) very much like insulin, which can be used subcutaneously, but one should be warned against that because too much may do more harm than good.

I might have gone on and said something about certain diseases which are usually considered nutritional diseases and their effects on the teeth, such as, for example, congenital syphilis. There are a good many who feel that the characteristic changes in the teeth brought about by congenital syphilis are in reality merely the changes of severe undernutrition caused by the syphilitic virus. The characteristic changes in the maxillary incisors, however, would appear to be more an effect of the syphilitic virus on the embryonic structure than merely nutritional change. We have seen the characteristic Hutchinsonian incisors and "mulberry" molars in children with congenital syphilis who have in no sense appeared to suffer from undernutrition during the period of infancy.

Regarding the question as to whether we would prefer cod liver oil to the newer preparations of ergosterol, by all means we would prefer the cod liver oil. I never give this new preparation of viosterol to anyone who will take cod liver oil. The cod liver oil is superior in that it contains the A vitamine as well as the D. But in the case of mothers during pregnancy, or in children where it is desired to give a large amount of the D vitamine, viosterol is invaluable.

As to the cause of rickets—a good many of the English and Scotch, particularly Findlay, have claimed that rickets is an environmental disease and not a nutritional one, that it is the result of poor environment rather than poor food. However, it has been found that the effects of poor environment may very largely be neutralized by good feeding, so you can take your choice.

As to the question of Dr. Morehouse relative to the mother's diet during pregnancy being changed in an effort to make the pelvis flexible, I should say that any diet that would make the mother's pelvis flexible would be such a bad thing for the baby that it ought not be given. Furthermore, I don't believe there is any diet that will make the mother's pelvis flexible.

I enjoyed Dr. Dewey's discussion very much, and am glad he brought out those points. Free discussion is the best means of arriving at correct conclusions.

As to natural versus artificial diet, it is true that the milk of a healthy mother is the best possible food for an infant; but unfortunately, all mothers are not healthy. The worst case of scurvy that I ever saw was in a baby who had been exclusively breast fed. The mother's diet was very poor.

Some of the worst cases of rickets are seen in negro children who have been exclusively breast fed up to the age of a year or more.

Some of the worst dental defects I have seen in children have been in those who have been nursed up to the age of eighteen months.

I have seen all those things in artificial feeding, too. I haven't seen them in babies who have received good human milk, and I haven't seen them in good artificially fed babies.

The actual facts in the case are that human milk has more calories to the ounce than most artificial feeding mixtures; it is less likely to be contaminated by bacteria because it comes directly from producer to consumer. (Laughter.) Most infants who are nursed at the breast take more ounces at a feeding than infants who are given the bottle. The baby at the breast keeps on nursing until its hunger is appeased. I have seen a month old baby take ten ounces at a nursing, whereas most of the books will tell you that the most it will take is four ounces. That is one reason the breast fed baby does better than the artificially fed baby. We give a baby a whole bottle full and let him take all he wants. If he cries, we give him another bottle.

Under those circumstances, I really believe the artificially fed baby is just as healthy, has just as much resistance to infection, and often develops just as good teeth as the breast fed baby. That is very heterodox, but nevertheless I believe it to be true.

As to the matter of cleanliness of teeth versus nutrition, one might consider that as an analogy to any sort of infection that occurs in the body. I believe we should consider caries as infection. If the nutrition is good and a person is in good physical condition, he is much less likely to get a cold than the person in poor physical condition. Cleansing the nose, washing it out with salt solution or antiseptics every day may have some effect in preventing it, but that is not going to have nearly as much effect as keeping in good condition. Germs that cause decay may be present in any mouth. The whole question is whether the nutrition of the tooth is going to be such that they can gain a foothold. Given enough germs and enough media in which they may grow, even the healthy tooth will certain succumb, but the poorly fed one will succumb very much quicker. (Applause.)

I'M IN, SAINT PETER, CLOSE THE GATE
OR
AFTER ME THE DELUGE

By Dr. Richard Summa, St. Louis, Mo.

BETWEEN lines of Dr. Brodie's article in the September issue of the International Journal of Orthodontia, Oral Surgery and Radiography one must read that a most prominent orthodontist fostered the puerile but nevertheless pernicious Arizona orthodontia law. Laws are aftentimes made to be broken—and that frequently by the one who fosters a law.

The writer of this article knows positively of an instance where a most prominent orthodontist wrote the by-law governing the election of officers of an orthodontic society. This law conformed to and was born of his idealism. However, on the occasion of the fifth annual election of the officers of that society the framer of that election law was himself the first man to violate it.

Orthodontists who have known other orthodontists, some of these most prominent, will use more mature discrimination for placing tablets in the Hall of Fame. Hence, the writer asks Dr. Brodie to elevate any prominent orthodontist to the high pedestal of omniscience and infallibility with much care and greater hesitancy. It is well-meaning but unfair to one's idols of youth to place them on too high a pedestal, because if such an idol should become wobbly and dizzy from morbid selfishness, exaggerated ego or senility, the resulting plunge might be a shock. With this in mind let us eliminate the argument that any restrictive law becomes sanctified because it is fostered by some one man or some one school.

In his recent editorial Dr. Dewey suggests that the American Society of Orthodontists should have been represented in discussions of a proposed restrictive law. The writer of this article had the honor to be the first man to suggest an orthodontia society of national scope and to move that such a society be organized. A few months later he also selected the name "American Society of Orthodontists." Consequently, he feels qualified to express an opinion on this issue.

The American Society of Orthodontists is national in scope because malocclucding teeth and the need for their correction is not a bit provincial. The advancement and perpetuation of all phases of orthodontia are of most sincere interest to this organization. It will puzzle anyone to find a valid reason, then, why this society should not have been asked for an opinion regarding any proposed legislation of interest to orthodontia. In view of this fact, Dr. Brodie's attempt and failure to explain this neglect is pardonable.

However, his insinuation that orthodontia laws are a matter of states rights opens another debatable issue. The question of states rights has a reason for existing; nevertheless, it has been used as a subterfuge for indiscriminate

political propaganda. States rights, like all other virtues, have a decided limitation. Has it ever occurred to those who yield to states rights sincerely or insincerely that there is a decided and plain line of demarkation between professional and commercial pursuits?

Every dictionary thus far printed defines a profession as a vocation demanding special training or skill. This is absolutely incorrect and indefinite. There is no vocation, including that of shoveling sand which does not require special training. Let us define a profession as a vocation dealing with the spiritual and physical suffering of mankind, and as such is not to be boiled in the legal pot with commercial pursuits dealing with various commodities and the almighty dollar as its highest aim. If this definition should prove acceptable to many of my colleagues, may I not have their support in taking state dental laws out of the category of states rights and put into the broader field of national and even international rights?

State laws controlling professional pursuits might have had a reason for existing, but at this stage they have outlived their usefulness and, more than all, their justice. I daresay that even most prominent orthodontists will agree with me in this matter. Why should orthodontists attempt stifling methods of legislation comparable to the stifling methods of the anti-evolutionists?

In regard to the attitude of most dental colleges toward orthodontia, we need not be surprised that a most prominent orthodontist and those who were his idolizers for a limited period have taken up the slogan that the teaching of orthodontia is not compatible with the teaching of other dental college subjects. Did not this antagonistic and deterring cry create a reaction of fear, indifference and antagonism on the part of many dental college faculties?

In order to uplift any educational issue, constructive encouragement is absolutely essential. Destructive criticism and unfounded pessimism have never advanced any cause. The majority of dental colleges, which in the opinion of Dr. Brodie and his collaborators are not up to the standard of preliminary orthodontia training, could be induced to come up to a higher standard if approached correctly. Here again the process of education will bear better fruit than restrictive legislation.

The writer has taught this branch quite extensively with the full-hearted support of the dental faculty of a state university for twelve years. He is inviting an investigation of his method. Furthermore, he is willing to establish another such course with the identical support, in any college in the country if invited to do so, and then to have this course observed for criticism by any fair committee appointed by those who share Dr. Brodie's expressed views. No less a personage than Dr. Angle is urged to join such a committee. This challenge is made with an absolute sincerity of purpose. Perhaps other orthodontists might issue a similar challenge.

In the school where the writer taught, the graduate had to "know the fundamentals as the orthodontist must know his," hence the preliminary training was a good one for the orthodontist and very economical. The writer cannot conceive of any training of dental mechanics and fundamental dental theory which one must unlearn in order to become an orthodontist after grad-

uation. The dental colleges today average up to the standard of all other professional colleges.

It is more pitiful than deplorable that the Grand Man of Orthodontia has taken the untenable stand that orthodontists should be derived from ranks other than the dental profession. Carrying this vagary to the nth degree we might expect theologians to be enrolled as orthodontia students. It is fortunate that most of the Angle school graduates who became infected by this germ experience an early renaissance.

A restrictive law such as the Arizona law, admittedly based upon local initiative, makes one surmise that the law was calculated primarily for the protection of those occupying a fortunate position within the closed gate and not for the laity. Be that as it may, it is a fact readily observed that of all the dental branches, orthodontia is the one practically never practiced by the charlatan, commonly called quack. This is attributable not alone to the fact that orthodontia, more than any other branch of dentistry, requires a post-graduate finish, but because of the long period of time required to carry on orthodontic correction. Orthodontia has a natural safeguard against quackery.

As a class, no higher type of professional men can be found anywhere than the men who studied at the Angle or the Dewey schools of orthodontia, and they were—everyone of them—dentists. Anyone who holds to the opinion that only one man in the profession is right, brings to mind the anecdote attributed to the good old Irish mother who upon viewing her son during military parade concluded that all the boys were out of step but Jim.

The Arizona law, let us hope, will be the incentive for the dental profession to rise as one man to repulse further invasions of personal rights prompted by morbidly selfish motives of a few, and to create a sentiment which will exterminate the antiquated subterfuge of states rights for the control of professional pursuits.

"THE STORY OF A FAILURE"*

By W. A. Bulleid, L.D.S., England

MR. BULLEID craved pardon for climbing into the pulpit when, he said, his proper place would be the penitent's bench. When he received the Secretary's circular letter asking for Casual Communications, it occurred to him that possibly it might be a source of some little amusement to those present and of much profit to himself if he induced a discussion of one of his failures.

Quite unblushingly, therefore, he was going to show a case that he had had under treatment for some four years with a result that even a most partial friend would only characterize as deplorable.

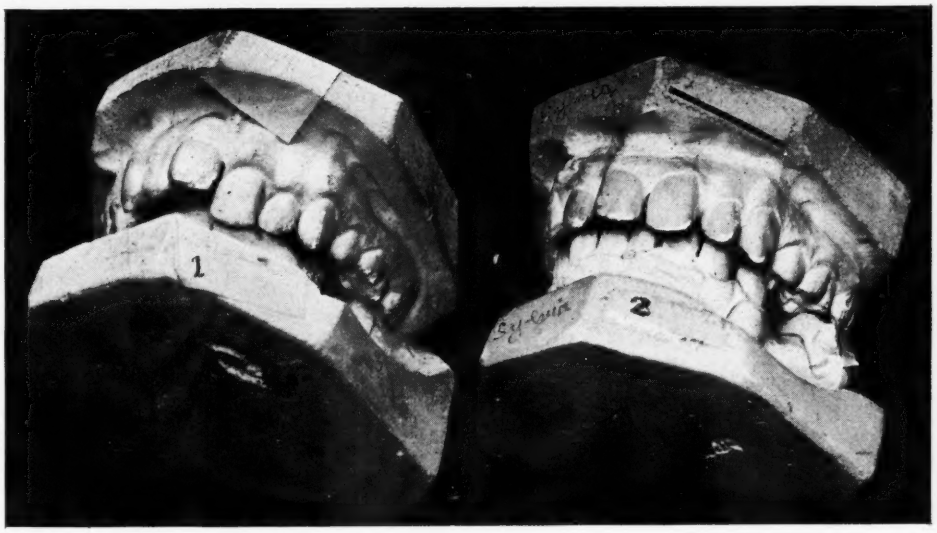
Perhaps he might just chide the Secretary for quite spoiling the title of his short paper by substituting for it the chilly and colorless sentence on the agenda. A good title covered a multitude of sins. Those of them who had seen Barrie's delightful play, "What Every Woman Knows," would remember Maggie peptonizing John Shand's speeches. Where he had insipidly written something about "Stemming the flood," she at once transmuted it into "damming the torrent." Well, what he had written was, "What would you have done?" or "The Story of a Damned Failure." He hoped that members would tell him what they would have done in treating this case and why it was such a failure. Apart from the question of treatment the case had one or two points of intrinsic interest. The first was that had the child been seen at about five or six years of age, then treatment would have been comparatively simple and probably fairly successful. As it was, she was thirteen years of age when he first saw her. She was the youngest of a family of five children; he knew the mother and three of the other children. They all showed exactly the same deformity, though to a lesser degree. They were certainly not physically robust, being of a lank weedy habit. With one exception they were organically sound but poorly developed. There was therefore a definite family history of the same malocclusion in one parent and at least three other children, and he thought only a bold man would deny a hereditary causative factor in this case; he was convinced of it himself. Some might remember that last year he showed two cases when he ventured the opinion that in them heredity played no part in producing the malocclusion, that the cause lay in some obscure factor local in its incidence and effect, and that the deformity, though excessive, was confined to the alveolar bone and arches.

He based this conclusion on the fact that restoration to normal was very easily and quickly attained and that little or no tendency to relapse was manifest, his argument being that it was inconceivable that a deep-seated hereditary malformation would respond to treatment so readily. In the case pre-

*Transactions of the British Society for the Study of Orthodontics.

sented the exact opposite was the fact. There was a definite family history of similar deformity. The teeth were very resistant to movement, and the tendency to relapse was excessive. He was dealing with a condition in which the whole of the bones of the face were involved and not the alveolus alone.

The more cases he saw the more he was becoming convinced that orthodontic cases fell broadly into two classes. (1) Those in which a hereditary or at least a prenatal factor was the predominating cause, and in which the deformity involved the whole of the maxillary bones at least and not the alveolar alone. Resistance to tooth movement was great, and the tendency to relapse most marked, the formation of new bone being very slow. This type of case seemed to give the best result if treatment was undertaken before the eruption of the permanent teeth. (2) Those cases in which the deformity was confined to the alveolus alone, the disturbing element, whatever it may have been, being quite local both in incidence and effect. These cases seemed to him to respond easily to treatment and did not relapse readily.

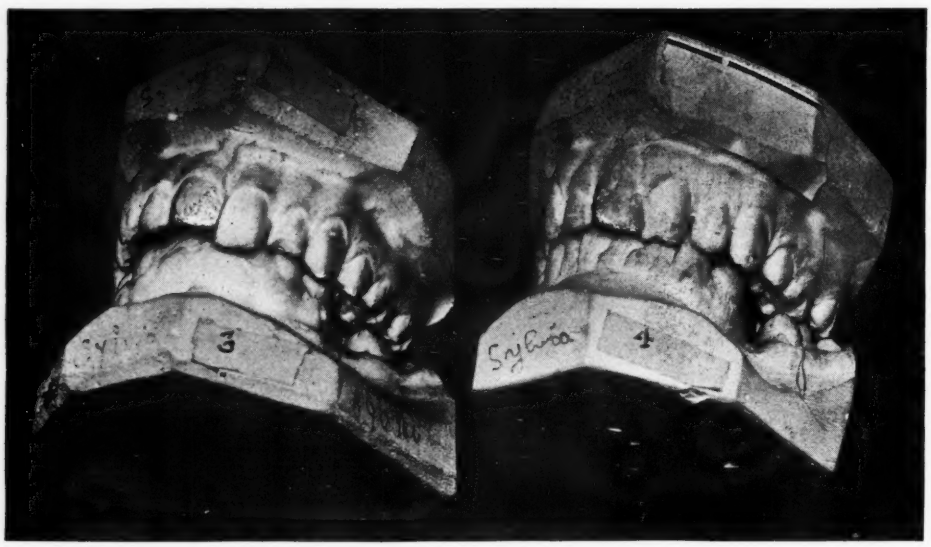


Figs. 1 and 2.

Turning to the models, the first, dated January, 1922, showed the imperfectly developed mandibular jaw and the marked underdevelopment of the alveolus in the molar region. The maxillary incisors reached well below the cervical margins of the mandibular, so excessive was the overbite. The retrusion of the left maxillary incisor only was curious, and he could not account for it. The first mistake he made was in not x-raying the case. He did not realize for some time that all four second premolars were congenitally absent. Treatment commenced with ribbon arches having bracket bands on maxillary and mandibular incisors, the arches being adjusted to depress both sets of front teeth into their sockets and intermaxillary elastic applied.

In December, 1922, things were as in the second model, and he began to think he might accomplish something. As there were no signs of the second premolars, he x-rayed and found them, to his chagrin, absent. Clearly, the only thing one could do was to raise the bite and retract the maxillary incisors.

To this end he removed the maxillary arch and put in a bite-plate. The next model showed the case in April, 1923. Then he made his next mistake when he got impatient and reverted to intermaxillary traction, with the lack of result shown in the fourth model, in October, 1923. Of course, he realized he had "got the wrong sow by the ear" and that it was futile to try to do anything save concentrate on raising the bite and encouraging growth in the molar region. He therefore put a vulcanite plate in the mandible to maintain the mandibular incisors in place and to fill the gap of the missing premolar and reverted again to the bite-plate in the maxilla. The next model was taken in September, 1925, and showed some growth movement in the posterior alveolus. What little, if any, there was had been stimulated by the eruption of the second molars. The incisors, however, had relapsed. He added a finger spring to the bite-plate to retreat the right ones, and in April, 1926, things remained as in the next model. He did not think any marked change had occurred since then.



Figs. 3 and 4.

Altogether there had been some slight improvement, but it was a pitiful state of affairs. Like the poor, this person would be always with him, only it was he (the speaker) who would be the poor. She would always have to wear a plate in the mandible, and probably in the maxilla too.

DISCUSSION

The President said that they had all had their failures in treatment and their successes, and they had found that it was often possible to learn more from the presentation of a failure than from the presentation of a success. They were much indebted to Mr. Bulleid for bringing forward this communication. He would like to ask him whether there was any habit which might bring about the deformity.

Mr. Carl Schelling said that Mr. Bulleid on a previous occasion had instanced a success, and this evening he had given them the other side of the picture. A patient 65 years of age came to him long ago and told him the treatment which he had had in his early days from Hamilton Cartwright, who made for him a vulcanite biting-plate completely covering

all his mandibular molars and premolars. Since then he had periodically eaten down this old bite-plate and came to have it raised as he had nearly come down to his natural molars, and his front teeth were ground down almost to the level of the gum, but he had lived a very happy masticating life. This man only spoke of Hamilton Cartwright's skill in treating him in the way he had done. He hoped that Mr. Bulleid's patient, when she also came to be 65, would similarly praise the care with which she had been treated by him.

Mr. Maxwell Stephens said that Mr. Bulleid's description of the two classes of cases met with might well stand. It was quite obvious that many cases that were thought to be extremely difficult worked out very readily, and those expected to be easy sometimes proved the reverse and subject to relapse. With regard to the case in question, the movement of the back molars was obviously the right thing to undertake to start with. One error, of course, as Mr. Bulleid admitted, was in not having secured radiograms. Occasionally owing to circumstances that mistake was made, and one got "caught out." As the second premolars were missing, there was no support in that region, and inevitably the bite must collapse again as soon as the retention appliances were taken off. In that case he thought that a bridge over the premolar space on the left side would assist in overcoming the difficulty; he wondered if Mr. Bulleid had thought of following that line of procedure. It might have been possible to have depressed the maxillary incisors in their sockets. He did not think that Mr. Bulleid should feel pessimistic, as looking at the first models, more had been achieved than he seemed to think. He agreed with a previous speaker that it looked to him as if the position of the three maxillary incisors on the right side might have resulted from a habit of the child, such as putting the thumb there, which had forced them into that position.

Mr. J. H. Badcock thought that they all learned more from their failures than from their successes, and he himself had had many opportunities of so learning. He thought that Mr. Bulleid was handicapped in the first instance by the age of his patient. Thirteen was an unlucky number and a very unlucky age at which to begin orthodontic treatment. Although one might move the teeth very often fairly readily, it was exceedingly difficult to retain them in their new positions at that age, and he had given up all attempts at expansion when the patient was as old as in this case. Mr. Bulleid had raised one or two important points. One was that they should undoubtedly, as a routine method, x-ray their orthodontic cases. He had not himself done so until quite lately, but it had been borne in upon him that it was the proper thing to do, and it would prevent the accidents that now and then happened when the absence of members of the permanent set was overlooked. He gathered that this was a postnormal bite, but he was not quite sure. He was not in favor of the bite-plate for the reason that it acted only when the teeth were in apposition, and the teeth were in apposition very little—only, indeed, when eating, for in the ordinary position of rest they were not in apposition. In a case which was at all difficult he much preferred the more active method of depressing the teeth by means of springy arches, which did the work very efficiently indeed. Mr. Bulleid asked for an explanation of the protrusion of the teeth on the one side and retrusion on the other. The speaker wondered whether the lip had anything to do with it; in some cases the maxillary teeth closed inside the lip on one side and outside the lip on the other, and, of course, it makes all the difference. It was just a possibility in this case. He also thought with Mr. Stephens that Mr. Bulleid need not be too pessimistic about his case. He had improved it a great deal.

Mr. Bulleid desired first to thank the members for the extremely polite way in which they had treated his paper. It was very kind of Mr. Stephens and Mr. Badcock to think he had improved the case. He would not say that he had not improved it to a certain extent, but he was not at all proud of it. Mr. Schelling had referred to a method of covering the posterior teeth with vulcanite and raising the bite in that way. He supposed it would have had the effect of improving the appearance in front. It did not commend itself to him in this particular case, for it would have been a handicap for the child to wear. He was pleased to hear Mr. Stephens appreciate his tentative classification. He had proffered it with some diffidence. It was based only on personal observation and not on scientific data. Of course, his (Mr. Badcock's) suggestion for bridging the gaps would meet the question of relapsing, but somehow or other the speaker had got a constitutional objection to mutilating sound teeth, and it would have mutilated at least four in this case. So far as habit was

concerned—and this applied to Mr. Badcock's remarks as well—he was not aware of any history of habit in the child, but it was a possible explanation that the habit of leaning on the arm had depressed the incisor teeth on one side, or possibly it had been brought about by lying in bed in the same way, which had produced pressure on that side. It was very stupid of him not to have x-rayed the jaws from the first. However, he had x-rayed them as soon as he began to be suspicious. He could not agree with Mr. Badcock that the bite-plate was an inefficient method of raising the bite. He had had some extraordinary success with young children in using the bite-plate, and almost nothing else, in promoting growth in the posterior alveolar region and a definite drift forward in the mandibular jaw. His experience was driving him to use the bite-plate more and more, with or without arches. He had been struck by what Professor Brash had said at a previous meeting about the alveolar growth, and it seemed to him that the bite-plate would assist that materially. The retrusion of the front teeth was not due to the lip being on the other side of the teeth but was due to some more obscure reason. He wished to thank them again for the very kind way in which they had received his communication; the penalties had not been very severe.

CASUAL COMMUNICATIONS

The President (Mr. Highton) said: I wish to bring forward this evening a short report of children of the same family, showing one case of malocclusion. There are three boys and one girl, the eldest being a boy 9½ years of age. The next two—boy and girl twins—7½ years of age, and the youngest a boy 4 years of age. They are all of average height and weight, except that perhaps the girl twin might be very slightly below the normal. The father and mother's health is good, and there was a normal birth in each case. All the children were breast fed for periods varying from six to eight months; they have had practically no sweets, plenty of fruit, and the mastication is fairly vigorous in all cases. Both the twins had adenoids and tonsils removed at the age of 3. The girl twin sucked her thumb from nine to eighteen months when the habit was definitely broken; the other children acquired no pernicious habits. The first models are those of the eldest child, which show normal occlusion. This is probably the type of case to which Hillman refers when he states that one may get a range from edge to edge to a deep overbite which cannot rightly be termed abnormal. This boy had had one filling in the right lower second deciduous molar. The youngest child, 4 years of age, is caries free, has an excellent record in regard to health; his occlusion is normal, but I am sorry I am unable to show the models, peaceful persuasion having failed. The next models are those of the twin boy; he is also caries free and the occlusion is normal, but he at present shows an edge to edge bite in the incisor region. The last models are those of the twin girl, also caries free. These show definite postnormal occlusion, Angle's, Class II. The mother is quite definite with regard to the duration of the habit of thumb-sucking, and apparently there was very little history of mouth breathing. This case struck me as being very interesting from the fact that it appears to show the comparatively simple manner under modern conditions in which malocclusion is brought about and the far-reaching effect of pernicious habits. Though to what degree either was responsible is difficult to say, except that we have here the comparison with the brother who also developed enlarged tonsils and adenoids but not the habit of thumb-sucking. It would appear that the latter had brought about the variation in the case of the girl.

The President announced that Mr. Evans was unfortunately unwell and was unable to make his communication personally. He had, however, sent his models and notes to the Secretary, and he would therefore call upon Mr. Packham to read the communication as follows:

The girl was a big, healthy girl of 12 years of age. She first attended the hospital under Mr. Dolamore at the age of 6½ years. The first models were taken when he first knew her. She was then a well-grown girl with excellent lips and a good round full face and generally was in a perfectly healthy condition. The models shown on the screen were taken in 1924. There was considerable overlap of the maxillary incisors, as could be plainly seen from the models, and it would be seen that she had what was called a "flush occlusion" both on the right and on the left. She had a considerable amount of close bite, and the

mandibular incisors were biting upon the cingula of the maxillary incisor teeth. It had fallen to his lot to decide what to do with the child. He thought she might be well described as a case of functional abnormal occlusion. She had a good bite and could eat her food perfectly well. Her lips came together, and there was scarcely any, if a little, caries. It was a clean, functionally healthy mouth. As he had said, it happened to fall to his lot to decide what to do, and he decided to do nothing but to watch the child, and he particularly gave the mother instructions to attend at the hospital at once if she found any tendency for the lower lip to fall inside the maxillary incisor teeth. That was the advice, whether good or bad, that was given. Subsequently the child presented again, according to his memory in about six months' time, with a distinct tendency for the lower lip to fall inside the upper one in the manner which was so commonly seen nowadays, the tips of the maxillary incisors just falling upon the lower lip; treatment was decided upon straight away. A bite plate was put in capping the premolar teeth. The inclined plane was adjusted so that the mandibular incisors impinged upon it, and also a wire was brought from the caps round to the other side with a U which could be pinched and the wire tightened up either side. In addition to that, a Badcock screw was inserted in the plate, so that further expansion could be got if necessary. The child had worn a plate of that description; it had been remade once or twice, and the models on the screen showed the girl as she was at present. The treatment had been remarkably successful. It had been very much more successful than the models showed. He could vouch for that because he knew the child. What he thought had been done was that the molar occlusion had been changed to normal. The models themselves could be seen afterwards, and it would be noticed from them that the cusps interdigitated very well. The anterior buccal cusp of the first molar fell in the correct buccal fissure of the first mandibular molar, and the premolars interdigitated quite nicely. Mr. Packham thought that the case bore on the discussion of Mr. Bennett's paper (Dental Record, August, 1927, page 401).

Mr. H. E. Marsh said he had brought forward the case he was about to describe because he thought it illustrated a common condition which occurred in the practices of most people. The first model showed the dentition of a girl, 10 years old, of the petite type, in good health, of slender build and with small bones. He had made a careful inquiry into the child's history. She was breast fed. There was no sign, nor had there been, of nasal stenosis, no adenoids, and no disease of the tonsils. She had no signs of malformation of the scapula, which was sometimes seen in mouth-breathers. She was not a mouth-breather, nor was there any history of thumb-sucking. The lower lip when first seen had just begun to form the habit of resting beneath the maxillary central incisors. There was a good deal of overbite. It would be seen how the mandibular incisors were biting in the palate. They were biting about three or four millimeters behind the maxillary central incisors. The occlusion at the sides was distinctly postnormal on the left and on the right. The models being opened showed that there was a great lack of room in the canine region. There were remnants of roots of deciduous molars still present in the maxilla. In the mandible the first deciduous molar on the left was touching the permanent lateral incisor. He did not know whether there was enough room for the tip of the permanent canine. He was wondering if that was a case where the occlusion had become postnormal as dental surgeons knew it, not on account of some prenatal or immediate postnatal cause, but because of the loss of the deciduous maxillary molars, which had allowed the first maxillary permanent molars to travel forward, and that having taken place the mandibular incisors had over-erupted and had started the vicious thing that was happening. There was proclination of the maxillary incisors. He requested the chairman to invite discussion on treatment in the case described, having regard to the small amount of room there was for the canines to erupt.

A member asked what the profile was like.

Mr. Marsh replied that when the lips were closed one would say at once that the child was a Class I child, and the upper lip was not short. Showing a further model, he said it showed the stage arrived at after a year's treatment. He had attempted to treat the case without any extractions of permanent teeth and had achieved what he thought was a great deal of expansion but still did not obtain enough room for the canines to come down, and it appeared to him that he was getting a mouth out of all proportion to the size of the child,

though he bore in mind that the child was growing. There was not much space between the premolars on the right side, and on the left there was a little more. If the models being shown were placed side by side with the original models, it would be seen that a very great deal of extra width had been obtained in the maxilla and nearly as much in the mandible, but he had still thought he was not going to make a success of the case, and extracted the first premolars in both jaws; and he was not at all sorry that he had done so, nor was he sorry that he did so much expansion, because he thought if the extractions had been carried out without any expansion at all a much worse result would have been obtained. The overbite in that case was corrected with a fixed appliance. The child had been without appliances of any kind for a year, and there was no tendency for the maxillary incisors to tilt forward, as far as he could see. Mr. Marsh said the case brought out a point that he had noted in practice for some years. In Class I cases expansion in many cases was insufficient, and one did not get retention, and in cases of removal of either of the cheek teeth one got collapse of the bite. For that reason one found the maxillary incisors were bitten forward again; but he had found, and he thought other members had found also, that if one combined the extraction with expansion one got good results. Where one was in doubt of the eventual future of the case, if one commenced by expansion one could see how the treatment evolved, and it was always left open to the surgeon to secure the retention of the incisor teeth in a better position esthetically by removing the premolars and drawing in the incisors, the combination of the two treatments being wisest.

Mr. Harold Chapman said there was one point he had noticed in the second model Mr. Marsh had shown on the screen, but he had not noticed it in the first, that was that the maxillary first permanent molars appeared to him to be rotated, and that would probably account for some of the difficulties which Mr. Marsh had found in obtaining sufficient room for the canines. Rotation of molars with the mediolingual cusp as the center of rotation occurs frequently; the effect of such a movement is to bring the mediobuccal cusp more forward and inward than usual; such rotation gives the first molar an appearance of prenormality, but such prenormality only relates to a part of the tooth; it is important not to confuse the condition with postnormality of the mandibular molar. He did not see how those molars had rotated in Mr. Marsh's case, unless they had been held back by deciduous molar roots and then subsequently moved forward and rotated at the same time. That would seem to be a rather unusual state of affairs to find, but then the case did seem to be unusual in other respects. He could not quite follow Mr. Marsh in his view that it was a Class I case. It seemed to him that the case was one of postnormality of the mandible. The case was unusual, too, if, as Mr. Marsh suggested, those maxillary molars had moved forward and the premolars had also moved forward at the same time. He did not remember ever having seen a case in which he could feel sure that that had happened. It seemed to him that what took place was that the molar might move forward if it had nothing to hold it back; and if that happened, one, usually the second, premolar erupted inside the arch; that was to say it was lingual to the general line of the teeth. However, he did think it was a very difficult case to diagnose, and one not only wanted to see the models, but also the child. He had been going to suggest—he was speaking as if he had not seen the subsequent models which Mr. Marsh had shown—that the case might have been treated as if it were a Class II case in the orthodox way, and if one wished to reduce the treatment to a minimum, one might have removed a mandibular incisor and two maxillary premolars, so leaving the mandibular arch much as it was, and the maxillary arch as it was, except to bring the maxillary premolars into line. Otherwise it could have been treated on orthodox lines, and it would not be necessary to remove the mandibular incisor.

Mr. Marsh said his idea was that it might have been that the deciduous molars broke down in early life, and space was lost, and the maxillary molars travelled forward. Subsequently the maxillary premolars erupted and were induced forward by the position which the maxillary molars had assumed.

The President said: Mr. Marsh has brought forward a communication which is very interesting from the fact that he has obtained an excellent result, without very extensive or complicated treatment, and one which also emphasizes the importance of a very careful diagnosis before commencing treatment. It always seems to me that particularly in latter

years one has had the opportunity of considering the various factors which have been presented to the Society, in the diagnosis and treatment of our cases, and a little careful study of original models as the case presents itself will often solve many difficulties without the necessity of having to resort to complicated appliances. The canines in this particular case have fallen into correct alignment, and the overbite has been considerably improved, also a functional occlusion has been obtained with, I have no doubt, a great improvement in appearance. The presentation of these cases is always valuable and instructive, being a departure from the usual routine of bands and arches and showing the advantage on certain occasions of judicious extraction. We often refer to the possibility of obtaining results by extraction in discussing the treatment of cases, and it is of interest to record the result of treatment by this method. The difficulties of attempting to retain the full number of teeth and also the correction of the overbite are very evident in the case presented by Mr. Marsh, and I congratulate him upon his result.

Mr. Pitts said he thought Mr. Marsh might have taken out the first premolars straight away. He doubted whether anything had been gained by the preliminary expansion because there was a considerable gap on the distal side of the canines, particularly in the mandible. When that was replaced by the premolar, the gap would be considerably larger. A gap behind a canine was always a noticeable thing; it might get less, but from the models it looked as though it might have been better in that case to have extracted straight away, without any expansion.

Mr. Marsh, in reply, said he was very grateful to Mr. Chapman and Mr. Pitts for their remarks. To a large extent he agreed with both of them, although they had different ideas about the maxillary molars rotating. They did rotate, and that was owing to lack of skill with the lingual arch. As to Mr. Pitts's point about extraction without expansion, that, of course, was a very tempting thing to do, but he had done it in a good many cases and found that the canines came down much nearer together than he wanted, i.e. the distance from the tip of the right canine to the left canine was not nearly as great as one would have liked, and he had felt in the present case that the stimulation of growth of bone obtained by mechanical expansion was beneficial. He agreed with Mr. Pitts, however, that there was too much room in the mandibular arch and that there would be some spacing. He would try to keep an eye on the child and see what the condition was like when she was 16 or 17 years old.

Mr. Cale Matthews brought forward Casual Communications illustrated by x-ray photographs and models shown in the epidiascope. The first was a boy eight years of age, who presented in December last an erupted supernumerary canine lying behind the right maxillary centrals. The x-ray revealed another supernumerary tooth placed vertically with the apex downward. A decision was made to extract the teeth, and the child was taken into a nursing home. He showed the two teeth extracted. There was a marked dissimilarity between them. The gum was freely dissected over the area, and the bone was removed with a large cross-cut bur, fortunately without going too deeply; the tooth was removed without fracture. There was a considerable difference between the size of the crowns and also in the shape of these two teeth. He called them supernumerary canine-form teeth because they presented that appearance. A model taken a month afterward showed the condition of the palate after the removal of the teeth.

The second case was in a girl of twelve. Clinically there was no evidence of anything abnormal either in the vestibular region or the palatal area. X-ray stereoscopic pictures were taken, which revealed the left maxillary canine lying very nearly horizontal and a marked absorption or lack of completion of the apex of the left lateral tooth. He wanted advice from any member who had had a similar case. The teeth were of good quality. He wanted to be quite sure whether the canine was labial or palatal. If labial he wanted to know that he was justified in endeavoring to draw it into correct alignment and that the damage or lack of development of the lateral tooth would recover and justify that treatment. Otherwise it seemed to him that the tooth would have to be removed and ultimately the deciduous canine would be lost, and following on general experience of such conditions, the lateral, owing to the lack of completion or absorption of the apex, would also be lost in a few years.

He showed radiographs of this case taken from different angles, by placing the film in the mouth, giving about half the normal exposure, then, without moving the film, moving the tube from 3 to 6 cm., resulting in a picture giving an idea of the relation of the different parts, also a complete palatal view. It was one of the most difficult decisions to make, whether to treat such a case from the orthodontic point of view or to use the forceps at this stage.

Mr. S. F. St. J. Steadman said with regard to the second case that he had seen, he thought, two or three such cases. His experience was that these teeth were nearly always on the palatal aspect. He had seen one or two deciduous canines in a patient very much older —twenty—and he could not see why that tooth should be lost as early as Mr. Cale Matthews seemed to think. He would be inclined to remove the canine and leave the other. He also pointed out that the apex in these teeth was often bent almost at right angles, and therefore the teeth could not be removed any distance. He had had one in which the apex was bent actually at a right angle, and he did not think any movement was possible there.

Mr. H. E. Marsh (Bexhill) mentioned a case which he had treated, as had another member who was presented, many years ago. The canine there did exert great pressure on the lateral incisor, which became loose and inflamed, died and had to be extracted. Since that time he had never had such a case as that with which Mr. Cale Matthews was confronted, but if so he thought he would make an exploratory operation under local anesthesia and try to find out exactly the relation in which the canine tooth lay to the other teeth, and having that in view, having removed at least enough bone to find out where the crown was, he would decide whether mechanical means of removing that tooth could be usefully employed or whether it was better left where it was, the flap sewn up, and the lateral given a chance to remain alive and firm.

Mr. Norman Bennett said that the second case reminded him of a somewhat similar case, a girl of about fifteen years old, in his experience. There the canine was misplaced, the deciduous canine was gone, and the space was to some extent closed up between the lateral and the premolar. There was no question of absorption of the lateral, but he had to decide whether it was possible to get the canine down. The gap was unsightly, and he cut down upon the canine, removed a certain amount of bone, and was pleased to find that after leaving it alone a little while it did erupt sufficiently for him to be able to work upon it and bring it into position. The case was never quite completed because the lateral was rotated and overlapped the central a little. In Mr. Cale Matthews's case he would very much doubt whether treatment of that kind would be successful, because it seemed to him that the canine was more misplaced than in his own case. He would be inclined to remove it and leave the deciduous canine there.

Mr. A. L. Packham thought that Mr. Cale Matthews might have some difficulty in persuading the parents to allow the extraction of the lateral. It might be suggested to them that the tooth should be tested for thermal changes once a month for six months, and as the tooth would undoubtedly die in due course it could be demonstrated to the parents that extraction was advisable.

Mr. Northcroft said that one never knew when the tooth might die and a septic abscess form. It was necessary to keep it all clean and healthy. It would be a great mistake to let the pulp of that tooth die and possibly suppurate.

Mr. Norman Bennett did not see any reason why it should die at all. There was nothing to make it die. The deciduous canine might remain in position for many years.

Mr. Cale Matthews said that he was deeply grateful to the members who had spoken. This child might not come under his hands for treatment at all. She was sent to him in consultation by a very able operator who did not practice orthodontics, and he gave him advice which he thought practically coincided with the opinion conservatively expressed by those speakers who would endeavor to retain $|\underline{2\ 3}$, that an exploratory operation should first of all be undertaken to see exactly where the canine lay. But the time would ultimately arrive when the deciduous canine was lost and when a damaged lateral such as this might be also lost. Then the difficulty, later in life, of having to draw the canine into position, or, if removed at this stage, of having a space of two teeth. There was no impossibility about

drawing teeth into position if the operator was equal to the occasion. If that lateral had to be removed and the canine was drawn into position, it would be possible to fill the lateral gap with a Carmichael crown carrying the lateral facing, and the ultimate esthetic appearance of the child would be very good. The loss of the lateral was serious to a girl, and the loss of a canine, in view of its function, was also serious. That was the advice he gave, and he thought it very much assimilated the idea of the members who had spoken. He was grateful for what they had said, and the little discussion illustrated again the great value attaching to the meetings of the Society.

Index to Dental Literature*

THE 1924-26 Index to Dental Periodical Literature is now ready for delivery. This volume of the index is similar to previous volumes prepared by the Dental Index Bureau, and we believe every practicing orthodontist should possess all the volumes.

The new index is indeed rich with orthodontic material and will prove quite a revelation to the profession itself, for literature relative to orthodontic science has developed by leaps and bounds.

The Dental Index Bureau is to be complimented for the wonderful work it is doing, and we can show our appreciation by subscribing to the 1924-26 Index of Dental Periodical Literature. The price of the volume is $6.

*The Index can be obtained from the office of the secretary-treasurer of the Dental Index Bureau, Dr. Abram Hoffman, 381 Linwood Avenue, Buffalo, New York.

ROTATION OF MOLARS

By Sheldon Friel, B.A., M.D.Sc., England

MR. SHELDON FRIEL exhibited an appliance for the rotation of molars. The rotation of molars, he said, especially maxillary first molars, was not so uncommon as was usually thought. Hellman had pointed that out several years ago, and had shown that what was an apparent inferior post-normal arch relationship was in reality only rotated maxillary molars and consequent alteration in the maxillary arch. In cases where there had been premature loss of maxillary deciduous molars, the maxillary first permanent molars frequently rotated and partially closed the spaces for the teeth anterior to them; maxillary molars usually rotated around the mediolingual cusp. Personally he had had no satisfactory method of rerotating molars until he had devised this appliance. Fig. 1 showed in a diagrammatic form the result of rotated molars; Fig. 2 showed the appliance. Plain bands were made for the molars, and round vertical tubes *(A)* were soldered as near the point of rotation as possible. An arch was made to fit the lingual surface of the dental arch, with vertical round pins (*B*) to engage the tubes. Latches (*C*) were soldered to arch to keep the pins in the tubes. Arch diameter 1 mm. = 0.039 inch. Spring wire 0.47 mm. or 0.018 inch diameter was soldered at the disto-lingual angle of plain band (*D*) and the free end brought forward and wrapped around the leg of the arch (*E*). The spring shown in the diagram was the force that rotated the molar. The appliance was cemented in the mouth and allowed to remain for two or three months, in which time the rotation should have taken place. It was not desirable to keep on more spring than was necessary to get the correct amount of rotation.

DISCUSSION

The *President* remarked that Mr. Sheldon Friel's appliance was another illustration of the importance of careful diagnosis. It required a certain amount of genius to evolve such appliances, which, he thought, were very wonderful.

Mr. N. Gray said he had been using the method described quite a great deal, and it was extraordinary the way in which it did rotate the molars. Mr. Sheldon Friel had stated he used very thin springy wire. Personally he had been using a 0.030 wire and had found that then he had not needed latches on the little body wire.

Mr. Norman G. Bennett asked whether Mr. Sheldon Friel thought the movement described was a pure rotation round the mediolingual cusp, or a rotation combined with anterior translation. Personally, he thought it was combined with translation. In other words—to put it the other way round—he thought that when a maxillary molar moved forward it also rotated.

Mr. Northcroft suggested that it must be remembered that there was always the forward drift of the molars anyway. Undoubtedly only the rotation was corrected, but the teeth would move forward in any event; so that it did not much matter if this forward movement was not corrected.

The *President* asked Mr. Sheldon Friel what advantage he found over the method he had described as compared with that which had been suggested by Professor Johnson.

Mr. Sheldon Friel, in reply, said he had forgotten to mention one thing, namely, that the effect of the rotation was to take up the room of the teeth anterior to the first molar—not posterior to it; so that when one rotated the molar all the benefit was anterior to the first molar and not posterior to it. In reply to Mr. Bennett, personally he did not think it was necessary to have a forward translation combined with a rotation. One might have a rotation without the forward translation. He quite agreed that both were more

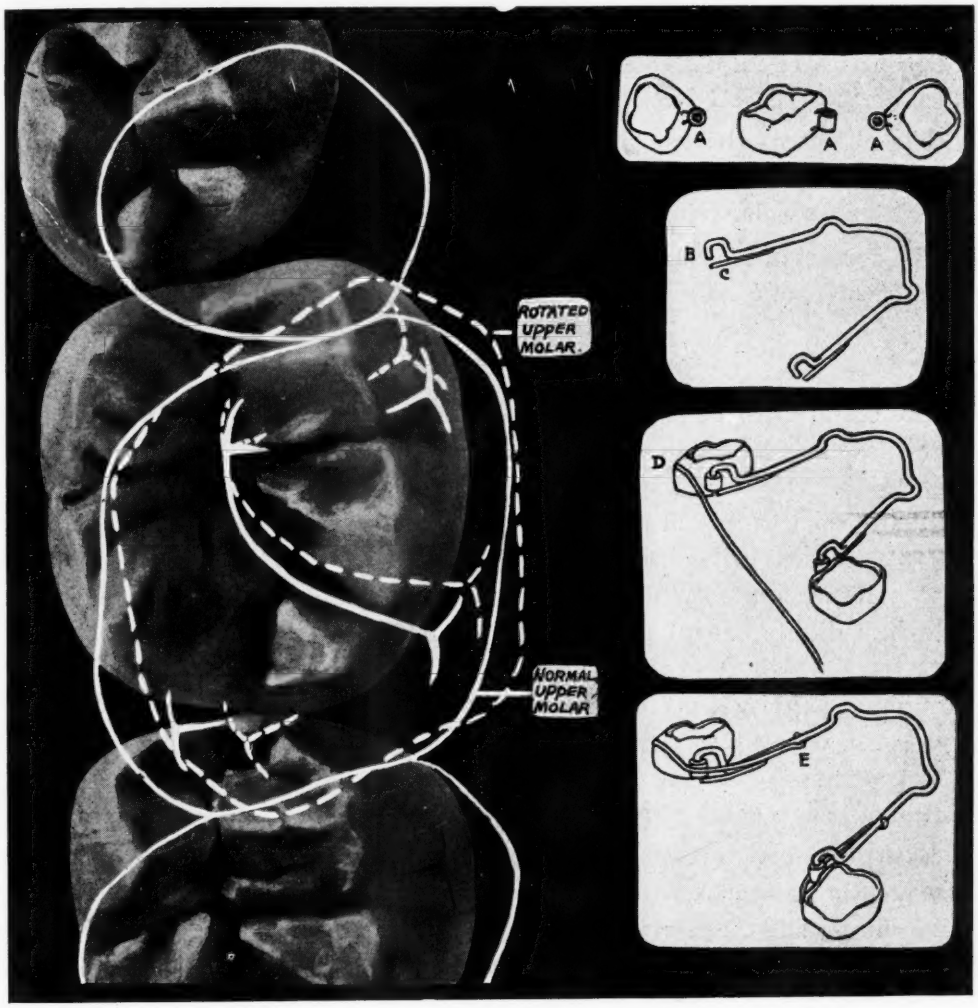


Fig. 1.

Fig. 2.

commonly combined, but it would be seen that in the models of a mandible which he had passed round all that had been done to cure that case had been to rotate the molars. It had not been moved bodily backward; it had only been rotated, and the two premolars had come up into place. The President had asked whether the method was better than Professor Johnson's method. He could only say that when Professor Johnson had been in London he had shown him this method, and Professor Johnson had passed it; that had been all he had been able to get out of him on the matter. Personally he had never tried Professor Johnson's method.

FACIAL MEASUREMENTS*

By Miss K. C. Smyth, L.D.S., England

THIS series of measurements has been undertaken for the Dental Committee of the Medical Research Council.

The object of the work is to establish the direction and normal rate of growth of the jaws of children between the ages of eight and fourteen years, with a view to comparison with the abnormal.

The system of measurements was originally devised by Mr. G. G. Campion, of Manchester, and so also were some of the instruments used.

SELECTION AND CLASSIFICATION

The children to be measured are selected from the London County Council schools. The only sine qua non in the selected cases is "normal occlusion" of the teeth. Only the most trivial variations from what is generally recognized as normal occlusion are included. This high standard results in a very small percentage being selected. As an actual fact it is about 6 per cent, but this is not quite so depressing as it sounds, because many more cases would be suitable except for the loss of one or more of the teeth which are points from which measurements are taken. This of course does not necessarily imply abnormal occlusion, but it does make the cases unsuitable for the purpose for which they are wanted. On the other hand, if any teeth which are not points for measurement are missing, and the spaces are properly maintained, such cases are included.

Both sexes are examined, and the names of the children selected are taken. Subsequently these cases are classified according to sex and age. There are twelve six-monthly age-groups in each sex, between the ages of eight and fourteen years, and each group is to contain fifty cases, from which the averages of the figures are to be obtained. The average age of each group is to be obtained, and the average increases of weight and height. Weight and height (in ordinary clothes, without shoes) of each child is recorded within a few days of the taking of the facial measurements.

All the above work is carried out single-handed, so as not to waste time when help is not required.

THE MEASUREMENTS AND INSTRUMENTS

There were originally five groups of measurements and twenty individual measurements taken in each case.

*Transactions of British Society for the Study of Orthodontics.

Groups	*No. in Each Group*
(1) Anteroposterior group contains	5 measurements
(2) Depth of palate " "	1 "
(3) Breadth of face " "	2 "
(4) Length of face " "	6 "
(5) Breadth of teeth and dental arches	6 "
	20

(6) A sixth group, i.e., Length of dental arches will shortly be included.

(1) *Anteroposterior.*—These five measurements are all taken from the transmeatal axis to various points on the face:

(a) The nasion.
(b) The gum margin of maxillary incisors.
(c) In the incisive margin of maxillary incisors.
(d) The gum margin of mandibular incisors.
(e) The mental point.

All these are taken with the prosopometer devised by Mr. Norman Bennett in conjunction with the Cambridge Instrument Company. Its accuracy, which is much greater than that of other similar instruments, depends chiefly on its two pressure gauges. The one in the headpiece exactly balances the whole instrument on the top of the head, thus avoiding distortion of the transmeatal axis by dragging of the earpieces; the other, situated in the crossbar which carries the pieces of vulcanite actually used for taking the measurements, eliminates differences due to variations in hand-pressure and compression of soft parts. Thus it is an instrument which can be used, with a little practice, by any two people, with results which are in every way comparable with those obtained by any other two with a similar one.

(2) *Depth of Palate.*—This has been taken, up to the present, with a simple instrument which is probably known to everyone. It consists of a flat bar of metal, which is held horizontally across the upper arch, in contact with the cusps of the maxillary first permanent molars. A plunger passes through the center of the bar, at right angles, and is adjusted by turning a guiding cogwheel which engages with teeth cut in one side of the plunger. The latter is graduated in millimeters. In practice this instrument has been found unsatisfactory, owing to the cogwheel slipping, and a new one is being made as designed by Mr. Campion, which is much easier to adjust and to read. The plunger is cylindrical and moves through a sleeve, while additional security is provided by a small metal spring impinging on the side of the cylinder, preventing slipping. This instrument also combines an ingenious arrangement for taking the length of the arches, which will be described separately.

(3) *Breadth of Face.*—These two measurements are taken with calipers, the ends of which are protected by special attachments which prevent the sharp points hurting the face, while they do not actually keep the points away from contact with their objectives.

(a) The distance between the most prominent points of the zygomatic arches. These points are first roughly gauged as being on a line passing from the external auditory meatus to the angle of the eye. The calipers are held horizontally, scale upward, by my assistant, Miss Still, who stands in front of the child. She does not control the position of the calipers, but takes the weight and follows my movements as I palpate the zygomatic arches from behind the child, with the ends of the calipers between my fingers and thumbs. When the correct position is found, Miss Still closes the calipers gradually; when no lateral play can be felt with both hands resting on the sides of the head, and the calipers pressed from side to side, the reading is taken.

(b) The Bigonial measurement is taken with exactly the same procedure as above, but it is more difficult to find the correct points on the angles of the jaw. The head is tilted backward to make the angles as accessible as possible.

(4) *Length of Face.*—All of the first four of these measurements are taken from the nasion. The fixed jaw of the calipers is fitted into the nasion by means of a conveniently shaped attachment which is hinged so that the calipers can be rotated to bring the movable jaw into any required position on the midline of the face or jaws. The hinge attachment is secured firmly in position with the finger and thumb of the left hand, the rest of the hand resting on the child's head. The pressure causes a mark on the skin over the nasion, on which the hinge can be accurately fitted for subsequent measurements. The movable jaw is adjusted with the right hand, and if it is approximated too much, a pull is felt at once by the finger and thumb at the nasion; this forms a test as to the correct adjustment.

(*a*) Nasion to subnasal point.

This is difficult to take correctly owing to the variable amount of soft tissue.

(*b*) Nasion to maxillary incisors, incisive margins.

The movable jaw is adjusted so that it just touches the teeth when it is swung inward and outward, without pulling on the nasion.

(*c*) Nasion to occlusal surfaces of first permanent molars.

Another attachment is fitted on the movable jaw of the calipers, carrying a crossbar which is swung into the mouth and adjusted to the anterior cusps of the maxillary molars.

(*d*) Nasion to submental point.

This needs careful adjustment in order to get the instrument really on the border of the mandible.

(*e*) Mandibular incisors (incisive edge) to submental point; and (*f*) mandibular first permanent molar to lower border of the mandible.

Both these are taken with the calipers which are used for the breadth of the dental arches. The jaws have flat prolongations which grip the mandible and the teeth. The calipers are held so that these prolongations are at right angles to the long axis of the tooth. The reading is taken to tenths of a millimeter, with a vernier.

(5) *Breadth of Teeth and Arches.*—(*a*) and (*b*) are the width of the maxillary centrals and laterals. These were recorded for some hundreds of cases

in both sexes, and the averages determined, and now the measurements are discontinued, as they afford no indication of growth-increases.

(*c*) Distance between first deciduous molars or first premolars (maxillary).

(*d*) Distance between first permanent molars (maxillary).

(*e*) Distance between first deciduous molars or first premolars (mandibular).

(*f*) Distance between first permanent molars (mandibular).

All these measurements used to be taken actually between the teeth, from the lingual aspects, at points on the gum margin which are the nearest to each other.

It was thought, however, that external measurements were more suitable, so the calipers now in use were designed to take these. The jaws so curved so that the breadth between the buccal surfaces (at the widest apart points) can be spanned without undue stretching of the mouth.

(6) *Length of Arches.*—

(a) Upper.
(b) Lower.

The distance between the distal borders of the first permanent molars and the labial surfaces of the central incisors will be recorded in future with Mr. Campion's instrument. It has steel flanges attached at right angles to the crossbar which rests on the cusps of the molars and these spring up behind the distal borders of the teeth. The instrument is T-shaped, the springs lying on the crossbar, and the measurements being taken by a slide working on the stem of the T, which is graduated.

RESULTS

An interim report was given in January of 1927. The averages were taken for twelve-monthly age-groups, as there was insufficient material for the smaller groups, and even so the numbers in some groups were very small. The table shows the increases very well on the whole, the discrepancies being accounted for in almost every case by insufficient numbers in a particular group. There were most inconsistencies in the breadth of arches group of measurements, and even now that the averages are more dependable, there are indications that very little, if any, growth will be demonstrated between any two consecutive age-groups.

The five anteroposterior measurements are omitted from this table, because Mr. Norman Bennett's prosopometer had only recently been completed, and it had been found that the old method was inaccurate.

Graphs were prepared to show the increases, but of course they are made ridiculous when the small numbers in one group give a false average. However, some of them are interesting.

It goes without saying that this January report has no permanent value but was made simply to give an idea of how the work was progressing.

Up-to-date, about 700 cases of the required 1,200 have been completed, and the thirteen- and fourteen-year groups in both sexes are practically filled up. There is going to be great difficulty in filling up the younger groups, as

almost every child between eight and ten either has badly carious deciduous molars or has had them extracted. It is most depressing to see such a very small minority of whole temporary dentitions, whether normal or abnormal.

I am afraid this paper is rather full of figures, and may have bored many people. It is much longer than I had intended, but it was difficult to make it complete in a smaller compass, so that, in conclusion, I hope you will forgive its length, and only remember the object of the work, with an impression that no trouble is being spared in order to obtain accurate results in every detail.

DISCUSSION

The *President* said that Miss Smyth was to be heartily congratulated on a very arduous and painstaking work, and on the interest which she had apparently shown in it. Very valuable results were bound to be obtained from the completed investigation. He presumed the work had been carried out in conjunction with other factors such as diet, health and early feeding.

Mr. Northcroft remarked that Miss Smyth had brought out one point which to him was very interesting because it bore out his own observations on the subject, and that was that the difference in measurements of the width of the deciduous and permanent arches was complicated by the great differences between the labiolingual diameters of the deciduous and permanent teeth. In the same mouth some deciduous molars were broader than the succeeding premolars, and some were narrower. Therefore he thought it was wise that all the measurements should have been taken from the outside rather than from the inside of the mouth.

Mr. Pitts said he desired to ask a question bearing on the same point, namely, whether in any particular age-group—taking the mandible—it was the distance between the first deciduous molars, or the distance between the first premolars (if they were present) which was taken, and if both measurements were included in that age-group. If in an age-group there were ten children with the deciduous molars present, and their measurements were taken, and thirty children with premolars, and those measurements were taken and included together in the age-group, it would seem to introduce the fallacy which Mr. Northcroft pointed out. In the case of the mandibular deciduous molar the buccolingual diameter was usually less than that of the premolar, and in the maxillary deciduous molar the buccolingual diameter might be greater. It seemed to him either it should be limited to the distances between premolars or to the distances between deciduous molars.

Miss Smyth replied that it was not settled yet by the authorities as to whether it should be limited to either one type of teeth or to the other. At present she had them mixed; but she always made a note of whether they were premolars or deciduous molars. She did not know whether Mr. Bennett had any information on the point.

Mr. N. G. Bennett said he thought Miss Smyth was in the happy or unhappy position of being in the hands of the Statistical Department of the Medical Research Council. There were wonderful methematicians who told the dental practitioners what he or she ought to do; they stated whether the numbers were sufficient to provide averages for the different age-groups, and whether they could make curves and graphs which might be regarded as reliable. In that matter the dental practitioner did exactly what she was told. She would probably be told that she must eliminate either the deciduous molars or the premolars, or that graphs would be constructed for each separately. Personally, he did not know which it would be; neither did Miss Smyth, but they lived in hopes.

DISPLACED AND IMPACTED CANINES*

A Radiographic Research

By Alfred Röhrer, Hamburg, Germany
Privatdozent and Doctor of Medicine, Röntgen Institut, Hamburg

IMPACTED teeth have a certain importance in dentistry, as through their influence pathologic processes may be set up. Such teeth can induce symptoms of pressure on erupted teeth, and thereby bring about simulated periodontitis; they can also cause trigeminal neuralgia, or even a follicular cyst may be formed.

In orthodontics impacted teeth have a particular significance. Impaction occurs in each group of teeth—with incisors, canines, premolars and molars. Very often in these groups of teeth impaction is observed with the canines. The orthodontist pays particular attention to the canine, as this tooth forms a special point, since physiologically as well as therapeutically, it plays an important part between the incisors and premolars, in the cosmetic and functional formation of the dental arch.

When looking for a displaced or impacted canine, two questions must be considered when the radiograph is examined:

(1) Is the canine infected?
(2) How is the tooth situated?

There is good reason for these questions, because, if the tooth is missing, the orthodontic treatment will be different from that used when the tooth is still in the maxilla. In the latter case the orthodontist will know how the tooth is situated, and if it will be possible to induce the displaced canine to take up its correct position.

An examination of the radiograph will at once give an answer to the first of the above two questions. In general, neither the radiographic technic nor the interpretation of the dental film is difficult.

If a displaced canine is found in the dental film we must next decide how this tooth is situated. An inclined, or oblique position of the tooth is easily seen. It is also not difficult to estimate how far the tooth crown is from the margin of the alveolar process, and also the situation of the displaced tooth with regard to neighboring teeth. But there are cases when such estimation is not so easy. For instance, it is more difficult in many cases to decide whether the tooth is situated on the buccal or the palatal side; and still more difficult when the tooth crown is situated on the buccal side while the apex of the root is on the palatal, and conversely. Again, the tooth may stand obliquely in the maxilla and at the same time be turned about its longitudinal

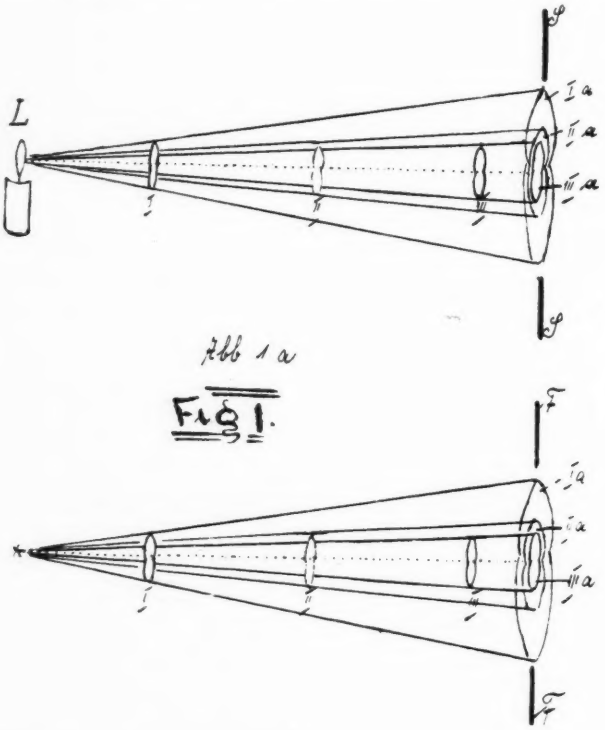
*Read at the Congress of the European Orthodontological Society, 1927.

axis. Here we have complications which render the reading of the tooth film very difficult.

In spite of these difficulties the radiograph should show how a displaced tooth is situated, and there are certain methods for this purpose which I shall now explain. First, in such a case, we must consider the shading of the tooth, as shown in the radiograph, and also its relation to other teeth. I will now deal with this matter theoretically.

Light emanating from a light source travels in all directions—we will now assume a source of light, select certain rays, and consider how these behave with respect to the shading of an object.

Fig. 1 *a* shows a ray of light striking a tooth situated at different distances between the light source L and the screen S. For clearness only one

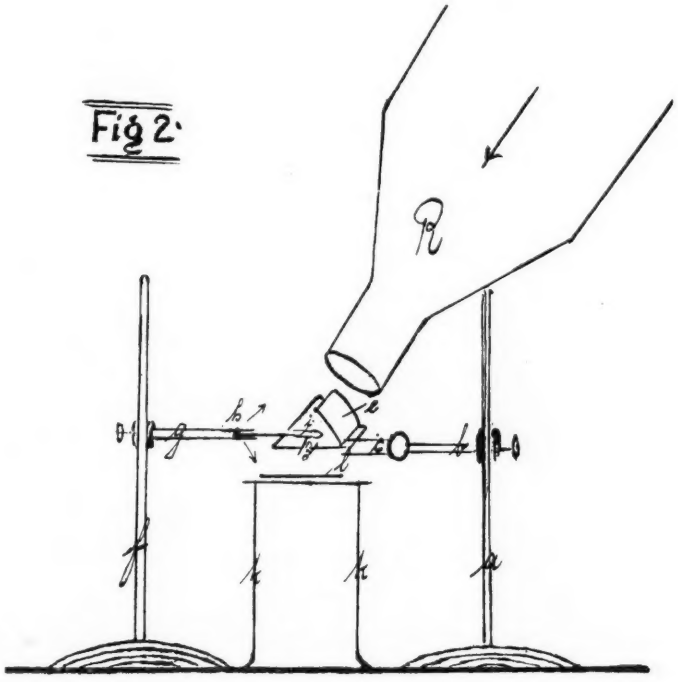


ray is drawn, while in reality a pencil of rays is under consideration. The dotted line represents a ray perpendicular to the screen. When the tooth is in position I, the shadow thrown is indicated by the black line at I *a;* this shadow is very large. The outline II *a* depicts the shadow corresponding to position II of the tooth. The path of the ray and the shadow are drawn; the latter in this case is very much smaller than before. If, however, the tooth occupies position III, the projected shadow shown by the outline III *a* is very small. It can now be seen from the arrangement of this experiment, that the nearer an object is to the source of light the greater is the shadow, but the less its intensity. Conversely, the nearer an object to the screen, the smaller and the more clearly defined is the shadow.

When we substitute for the source of light x-rays, we get the same relations; there exists in fact perfect similarity between the shadow producing action of the rays shown in Fig. 1 *a*, and that of the x-rays assumed in Fig. 1 *b*.

We will now consider only a single ray which strikes the object in positions I, II, III, and then traces on the film F the corresponding figures I *a*, II *a*, III *a*. I intentionally omit all secondary considerations such as the scattering of the rays, etc.—as I only wish to demonstrate by this simple example, that the conditions pertaining in radiography are similar to those when ordinary light is used.

Fig. 1 *b* shows that the picture produced by x-rays on a film is greater the nearer the object is to the point of issue of the x-rays, and conversely, the nearer the object is to the film the smaller is its projection. Again the clarity of the picture will vary in the radiograph in the same way as with ordinary light, namely, the nearer the object is to the film the clearer and more dis-

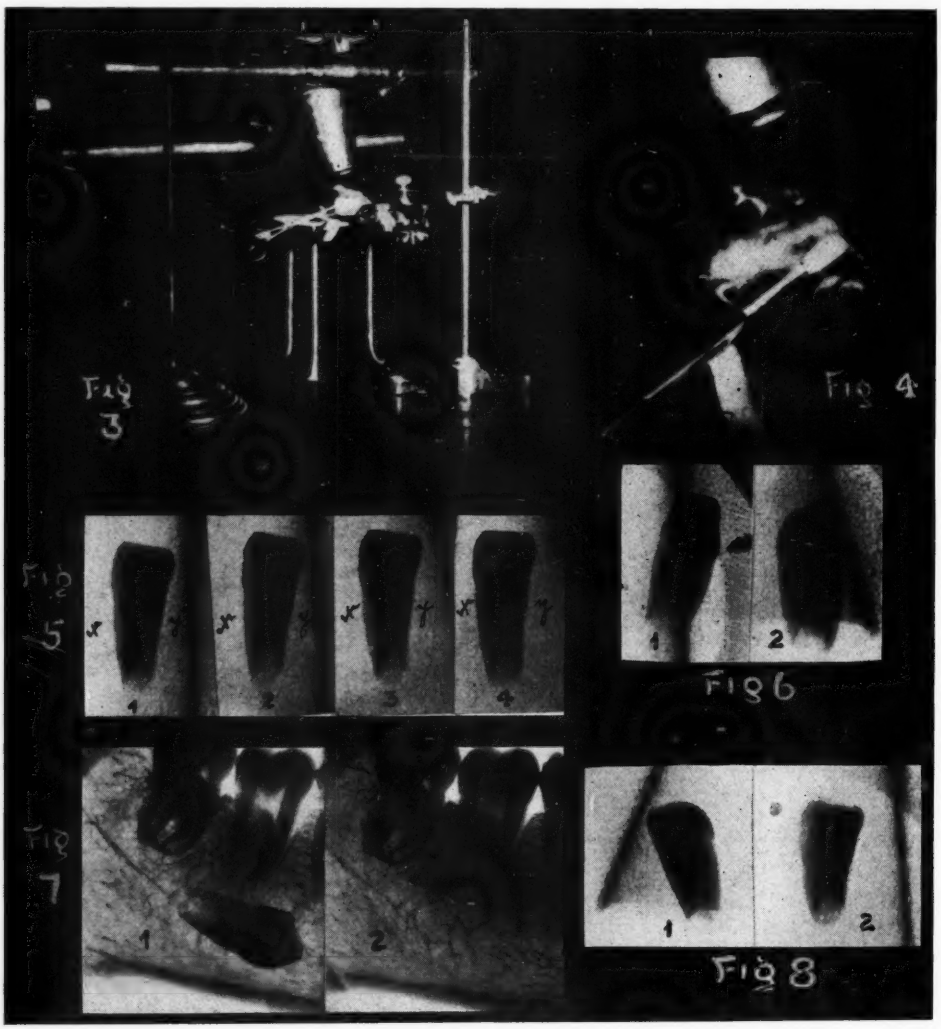


tinct the resulting picture, while the more remote the object is from the film the more indistinct is the picture.

I have subjected the above theoretic considerations to an experimental test, which I will explain by aid of Fig. 2.

The vertical rod *a* carries an adjustable arm *b*, this arm carries a clip *c*, in which is held an angular body which represents a piece of scapula, and out of this scapula is excised a piece of the spina scapulæ. The bony body thus formed has two planes, situated at an angle of 30 degrees to each other. The plane *d* can be considered as representing the palatal side of the alveolus, while the plane *e* represents the buccal side. The rod *f* carries the arm *g;* the end of this arm is movable about *h* in the direction of the arrows, and carries the tooth *i*. The film is placed on the support *k*. The tube of the roentgen apparatus R is directed toward the bony body *d e*.

By means of this apparatus it will be seen that it is possible to produce constant conditions when taking a radiograph. The position of the roentgen tube is constant, as is also that of the bony body *d e*—which is attached by the slide bar *b* to the rod *a*—as neither of the latter can suffer displacement during an experiment. Again the film *l* which is attached to the support *k*, is clamped in the same relative position during each succeeding exposure. The only movable part is the tooth *i*—which is attached to the arm *g*—and can be moved in the direction of the arrows about the point *h*.



Figs. 3-8.

Fig. 3 is a photograph of the apparatus. In this photograph the bony body with its interposed tooth is somewhat indistinct; this is due to technical difficulties experienced in the taking of the photograph. I therefore give an enlargement of this part in Fig. 4.

Now, as to the experiment. The results are given in Fig. 5. The tooth was placed horizontally and radiographed at different distances from the bony plane *e*, representing the buccal side. The different distances of the surface of the film from the internal planes of the bone are given in Table I.

TABLE I

DISTANCES OF THE EXTERNAL EDGES OF THE TOOTH FROM THE INTERNAL SIDES OF THE BONE IN MM.							RESULTS OF MEASUREMENT OF THE RADIOGRAPHED TOOTH IN MM.					
	Crown		Tooth-Neck		Apex		Breadth of Tooth			Length of Tooth		
Fig.	Pal.	Bucc.	Pal.	Bucc.	Pal.	Bucc.	Crown	Tooth-Neck	Apex	Edge X.	Over Root Canal	Edge Y.
1	5.0	11.0	0	11.5	1.5	18.0	8.4	7.1	4.2	19.5	19.4	19.0
2	7.0	9.0	3	7.2	3.5	9.0	8.5	7.1	4.2	20.0	20.0	19.0
3	9.2	7.2	5	5.7	8.0	8.5	8.4	6.8	4.2	20.0	20.0	19.8
4	11.0	4.0	10	1.0	17.0	1.2	8.4	6.8	4.2	20.1	20.1	20.0
									Difference:	0.6	0.7	1.0

In this table will also be found the various dimensions obtained from the results of the measurements. The space in which the tooth could be moved amounted to 10 to 11 mm. In position 1 of Fig. 5 the tooth was nearest to the film, and in position 4 most remote.

The importance of the different results obtained from the measurements of the radiographed tooth can be seen from the following: In position 2 the crown of the tooth appears a little broader than in positions 1, 3 and 4, which are identical. This result has, however, been caused by a slight rotation during the horizontal movement, as can be seen from the radiograph. The measurements of the breadth at the neck and apex have remained constant. On the contrary, the measurements of the longitudinal edges show a distinct increase, amounting to 0.6 mm. and 1.0 mm. between position 1, when the tooth is nearest the film, and position 4, when it is most remote. The mean increase in size amounts to 0.7 mm. Thus, taking the mean length as 20 mm., we have an increase of 3.5 per cent. This is very considerable, as the difference in position of the tooth during the experiment amounted to only about 10 mm.

For further demonstration I have shown in Fig. 6 (1) the difference when the tooth lies beneath the horizontal bone ridge, that is, between the bone ridge and the film, and in Fig. 6 (2)—over the inclined bone ridge and remote from the film.

TABLE II

THE RESULTS OF MEASUREMENT OF THE RADIOGRAPHED TOOTH IN MM.

FIG.	TOOTH BREADTH ON THE TOOTH NECK	TOOTH LENGTH
1	7.6	18.7
2	8.1	19.7
	0.5	1.0

Table II gives the results of the measurements. The increase in size between the position of the tooth near the film (1), and its position remote from the film (2), amounts to 0.5 mm. in breadth, and 1.0 mm. in length.

Fig. 7 shows more clearly the above differences. In this case instead of the bony piece, a macerated human mandible was fixed in position, and a tooth selected, corresponding to that in Fig. 6, was attached to the bony side turned toward the film. See position (1) in Fig. 7.

TABLE III

THE RESULTS OF MEASUREMENT OF THE RADIOGRAPHED TOOTH IN MM.

FIG.	TOOTH BREADTH AT THE CROWN	TOOTH LENGTH	
		PAL.	BUCC.
1	8.0	14.0	16.8
2	8.5	15.0	19.0
	0.5	1.0	2.2

In Fig. 7 (2) the tooth, a premolar, was on the opposite side. The measurements as given in Table III show very great differences, namely, in breadth 0.5 mm. and in length 1.0 to 2.2 mm. The details in the shadows in Fig. 7 are so well marked that all differences in measurement are clearly shown up.

Fig. 7 also shows that the root canal in position (2) is less distinct than in position (1). This circumstance is however easily explained. In the theoretic explanation accompanying Fig. 1 it has been shown that, with increasing distance, or nearer approach of the object to the light source, the shadow becomes greater, but less distinct. If we substitute for the source of light—x-rays; for the screen—a film, and use for the object a tooth, we have a complete correspondence in the experiments, as shown in my investigations.

In Fig. 8 the tooth in position (1) is so placed that the crown touches the internal edge of the horizontal bone ridge, and with the apex the oblique bone ridge, so that the crown is nearest the film. In position (2) the opposite is the case, namely, the apex is at the internal side of the horizontal bone ridge, while the crown is adjacent to the internal side of the oblique bone ridge. Thus in position (2) the apex is nearest the film. It will be seen that in position (1) the root canal is not very distinct, while the contrary is the case in position (2). Hence the root canal appears more distinct, the nearer it is to the film.

Combining theory and experiment we establish the following axiom:

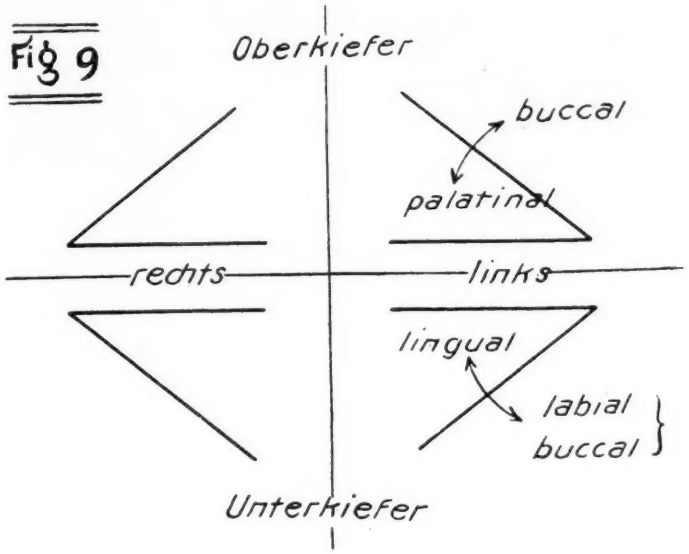
Assuming freedom from technical errors in the taking of a radiograph, then a displaced tooth in the jaw will be the more distinct as to details of structure, and appear the more normal in shape, the nearer the tooth, or a portion of it, is to the film.

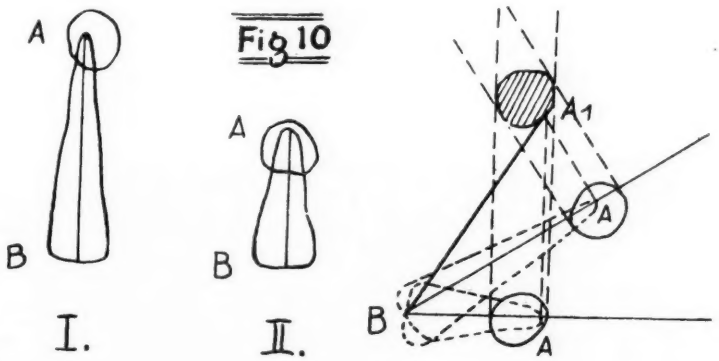
The above rule will help us in many cases to obtain clear and intelligible interpretations of tooth films. There are, however, some methods of procedure which assist us in such interpretations. One of these, due to Hauberrisser of Gottingen, is described in the *Zahnärztliche Rundschau*, 1926, No. 15, and entitled "Concerning the Radiographic Location of Dental Diseases and Foreign Bodies." This method depends upon the fact that the geometric position of a body in space can be determined when two different projections of the same are known. Hauberrisser, therefore, takes two different radiographs, one in the normal manner with the tooth film close to the jaw; in the second, the film is placed in the occlusal plane. Further, in the second exposure the roentgen rays must be so directed as to strike the film in such a manner as to coincide, as nearly as possible, with the longitudinal axis of the tooth; but the actual degree of the angle of incidence is not important. The result is a picture projected in length. We have now two exposures which can be used

in determining the geometrical position of the body. For this purpose we employ the diagram given in Fig. 9.

An angle is drawn which is open toward the midline of the body. One side of the angle is horizontal, the other runs upward, in the case of the maxilla, and downward in the case of the mandible. The details of the drawing, according to Hauberrisser, are shown in Fig. 10.

We will assume we wish to determine whether a granuloma is situated buccally or palatally. Fig. 10 (II) represents a normal tooth drawn with its





attached granuloma; while Fig. 10 (I) gives the lengthened tooth, also with the granuloma. The normal tooth drawing is now transferred to the horizontal side of the angle, and the lengthened one to the oblique side.

Now in each case where the apex of the tooth is cut by the sides of the angle, and also where the sides of the angle cut the granuloma, we erect perpendiculars. These perpendiculars will intersect either within, or without, the angle. When the points of intersection are situated within the angle the granuloma lies palatally (in the mandible lingually); but when these points are without the angle—then the granuloma lies buccally. In the case shown, see Fig. 10, the granuloma is situated buccally, see I A.

Fig. 11 A shows another example. The construction is the same as in Fig. 10. Here the granuloma lies palatally. The Hauberrisser method can also be used for the location of displaced teeth by determining the situation of the apices.

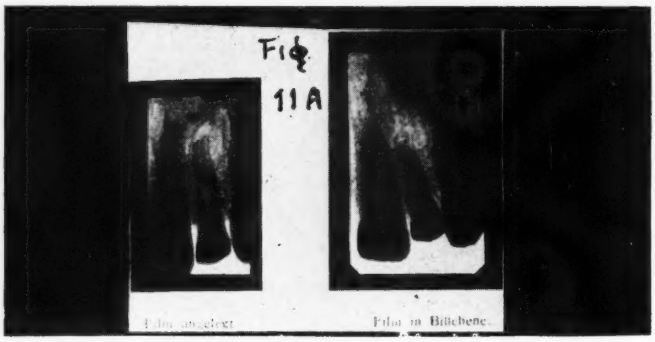


Fig. 11-*A*.

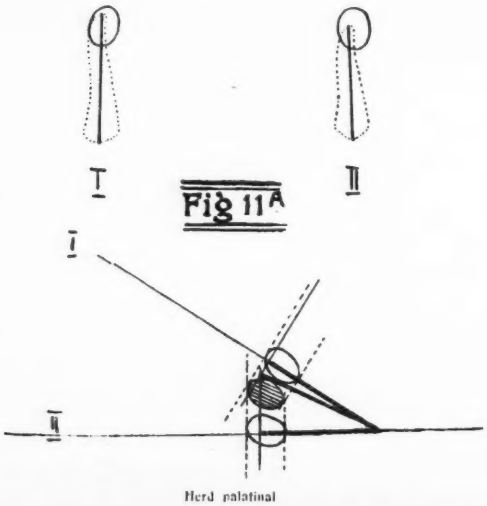


Fig. 11-*B*.

I have given in Fig. 11 B another case which I have first radiographed in the usual manner with my measuring apparatus, see (A).

The canine in the right of the maxilla lies obliquely and turned through an angle of 60 degrees. The crown, therefore, appears rather narrow, and the root broad; the root canal is seen distinctly—from which we can infer a rather

normal position in the frontal plane. Following Hauberrisser 1 have made a second exposure, see (b), taken in the occlusal plane. The accompanying four drawings, Fig. 11 C, show the Hauberrisser construction.

Here (c) shows the projection of the canine with regard to the oblique side of the angle, taken from the radiograph (a), while in (d) is shown the projection with regard to the horizontal side, taken from the radiograph (b). In both the corresponding perpendiculars have been drawn.

In (e) the figures (c) and (d) are combined; we thus obtain the linear intersections required. The result is shown in (f) by the dotted line. We see that the canine is situated between the sides of the angle; it is therefore in

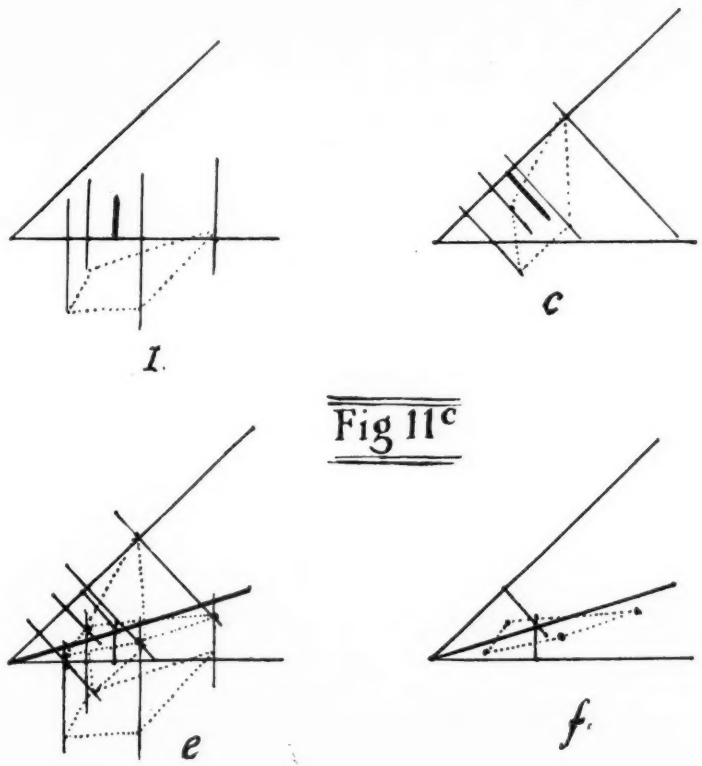


Fig 11c

the frontal plane, and in its normal position. The straight line between the sides of the angle denotes the construction of the longitudinal axis of the first premolar.

According to Hauberrisser his method gives approximately mathematically exact values.

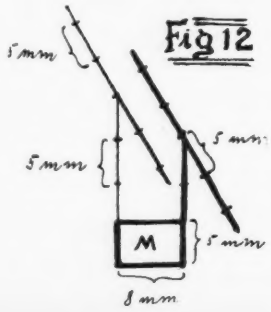
An apparatus which I designed and constructed, and which is also of service, is indicated in Fig. 12.

This apparatus consists of a square of metal foil of the following dimensions, length 8 mm., breadth 5 mm., thickness 0.27 mm. To each end of the foil is soldered a wire; these wires are of different thicknesses, one being 3 mm. and the other 5 mm. The thicker wire is 10 mm. long, and the thinner 15 mm. At distances of 5 mm. along the wires are attached small globules of solder. At the free end of each of the wires is soldered a cross-wire, making with the metal foil an angle of 90 degrees.

For the sake of stability the whole apparatus is made of platinum-iridium, and consequently it possesses some elasticity. It can be sterilized by boiling, or by means of antiseptic solutions.

Fig. 12 will show how the apparatus is used. The metal plate *m* is inserted between two teeth situated in the region of the displaced tooth which is to be sought. In most cases this is not difficult, but sometimes when the space between the teeth is narrow a certain amount of pressure is necessary; if, on the other hand, the space is too wide the metal plate is fastened by means of a little wedge-shaped piece of wood.

The wires in most cases conform well with the buccal and palatal sides of the jaw, and in any case can be easily pressed home. When the apparatus is



Figs. 13 and 14.

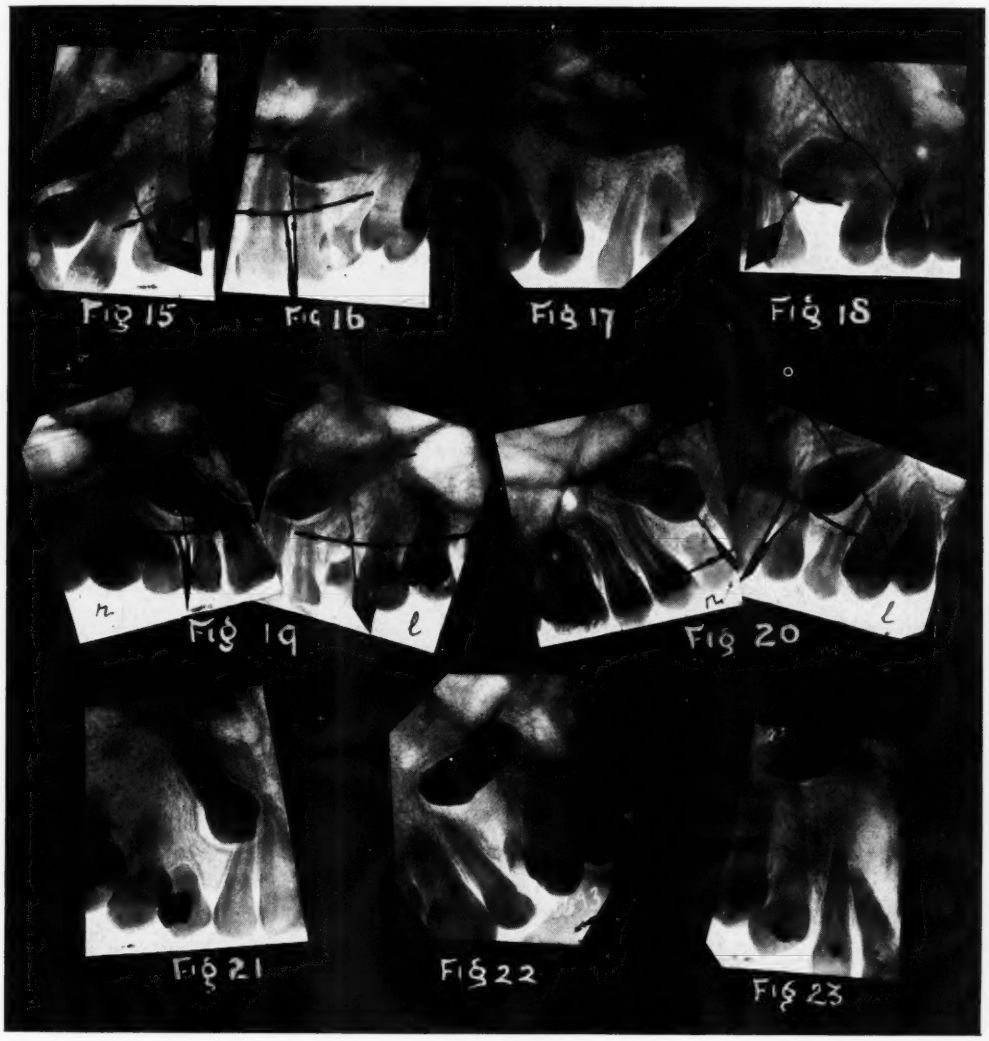
in place, the radiograph is made in the usual manner; the apparatus is then removed.

It must be emphasized that when using my apparatus the film must be read in accordance with the rules which I have already established.

Now it is in the nature of radiography that very frequently we have to deal with a distorted projection, the reason being that the teeth to be radiographed lie in a different plane from that of the film placed on the palate. The projections are more or less lengthened or shortened, so that when we wish to determine the distances of individual teeth from one another we are forced to estimate.

For the orthodontist it is important to know as accurately as possible the actual position of a displaced tooth. It is necessary for him to know how far the tooth is from the margin of the gum, as from this he can estimate how much time will be necessary in order to bring the displaced tooth into its proper position.

The above-mentioned apparatus is so placed that one wire lies on the buccal, the other on the palatal side of the jaw. Now in radiographing, not only is the projection of the teeth distorted but also that of the wires. The advantage of my apparatus lies in the fact that it is graduated at distances of 5 mm.; now these spaces of 5 mm. also suffer distortion, but owing to the graduating marks, the distances of a displaced tooth from nearby points can be easily judged. This can be seen in Fig. 13; in this radiograph the lateral incisor is sought.



Figs. 15-23.

Before discussing results obtained in cases of displaced canines I will show some radiographs, some made with and some made without my apparatus.

In Fig. 14 we have a canine which has not erupted. It is well developed and well defined, and situated in its normal place, but slightly obliquely in the jaw.

Fig. 15 shows also a displaced canine; it is very clear throughout its whole length—consequently this tooth lies palatally. The tooth is turned about its longitudinal axis, and lies almost transversely in the jaw; one-third of the crown has passed through the alveolar process. In spite of the apparatus

lying obliquely, it can be seen that the center of the margin of the root is 5 mm. distant from the margin of the alveolar process; the diameter of the root at this spot amounts to 5 mm.

With my apparatus it can also be seen that the displaced central incisor lies almost parallel to the canine; and further, that this tooth is turned in its longitudinal axis toward the sagittal plane. This example shows how valuable is the information obtained for the orthodontist.

In Fig. 16 quite different conditions are depicted. The displaced canine lies across the jaw; the crown is well defined, and lies therefore palatally; on the contrary the root appears rather broad, and the root canal is very indistinct; consequently the root is situated buccally. The tooth is turned through 60 degrees in its longitudinal axis. In this case by means of my measuring apparatus, the distance of the crown extremity from the margin of the alveolar process can be at once determined. This distance is about 10 mm. The radiograph shows that the tooth sac is very well conserved, this area being a little broadened.

In Fig. 17 the displaced canine lies entirely transversely, while the tooth is turned through 90 degrees longitudinally. The crown is clearly seen, and is situated palatally. The root is rather broadened, and the root canal scarcely recognizable. Consequently the tooth lies buccally. The distance of this displaced tooth from the apices of the other teeth can only be estimated; but had my measuring apparatus been used, those distances which would lie near the bar could be correctly determined.

The peculiar position of the tooth, the crown of which lies palatally while the root lies buccally, is shown more distinctly in Fig. 18, which also shows that the tooth is turned 90 degrees about its longitudinal axis, with the buccal side toward the alveolar process. In this case it was not necessary to use the measuring apparatus to obtain this important result. This example shows to what an extent the projections of the divisions on the measuring apparatus have been lengthened or shortened, and it can further be seen in the radiograph how great is the distortion in the region of the jaw.

A very interesting case is shown in Fig. 19, in which the canine is displaced in both the right and left sides of the maxilla. Both teeth are situated obliquely, but the one is rather more steeply inclined than the other. Both lie palatally and are turned about their longitudinal axis, the right however much more than the left. But while the right canine only just reaches the root of the central incisor, the left passes 3.5 mm. beyond the root of the other central incisor. This result can be read on the measuring apparatus, as can also that the upper third of the root of the left canine lies 5 mm. higher than the right. It can also be seen in this example that there exists no symmetry with regard to the displacement of these canines.

Fig. 20 shows the case of a patient in which both maxillary canines were sought. It is seen that these canines do not lie symmetrically. The right lies higher than the left, and the clearness of the projection shows that the root of the left tooth lies more toward the palatal side, while the root of the right lies more buccally. Again, the crown of the left canine lies more buccally, and the crown of the right more palatally.

We see in Fig. 21 the projection of a displaced canine which lies somewhat obliquely and high up in the jaw. The tooth is well defined, and lies palatally. I wish to draw especial attention to this tooth, as the tooth-sac is much wider than in the preceding radiographs; but this apparent widening of of the tooth-sac in the radiograph must not be taken as a sign of the formation of a follicular cyst.

On the other hand Fig. 22 shows a cyst between a displaced canine and the margin of the alveolar process. Now the question arises as to whether this cyst is of a follicular nature, since the root of the canine of the deciduous set projects 2 to 3 mm. into the cyst. It must be remarked, however, that it is very seldom that a cyst arises from the first teeth alone. Therefore the cyst shown in Fig. 22 should probably be regarded as a follicular one. The displaced canine lies with the crown palatally and the root buccally; it is, moreover, turned through 30 degrees about its longitudinal axis.

A rare case is shown in Fig. 23. Here we have a radicular cyst arising from both incisors on the same side of the jaw; this cyst with its roof touches the impacted canine, which is in the sagittal plane. The radiograph is to be interpreted as follows: the root canals of both premolars are very narrow, hence the root canals of the incisors ought to appear just as narrow, the wideness of the latter proves, however, that the disposition of dentine in the incisors has ceased for some time; therefore, the pulps of these two teeth must have been dead for a considerable period, hence the development of the cyst.

In order to obtain a general view of displaced and impacted canines, I have arranged my cases according to the most pertinent and important points which arise. I have considered sixty-four cases of displaced teeth in the maxilla, of which nine belong to both sides.

In Table IV will be found the distribution of displaced teeth with regard to the sexes and the jaw sides.

TABLE IV

DISPLACED CANINES

	MALE AND FEMALE	MALE	FEMALE
Right side	23 = 36%	9 = 14.1%	14 = 22.8%
Left side	32 = 50%	8 = 12.5%	24 = 37.5%
Right and left side	9 = 14%	1 = 1.5%	8 = 12.5%

It is surprising to note that the preponderance of displaced canines is on the left side; this is especially the case with the female sex, where it amounts to 37.5 per cent as against 12.5 per cent in the male.

But there is also a preponderance in favor of the female sex on the right side, amounting to 21.8 per cent as against 14.1 per cent in the male.

Still more surprising is this difference when we take the cases of displaced canines in both jaws; here it is found to be 12.5 per cent as against 1.5 per cent. From these results we find quite an enormous preponderance of displacements in favor of the female in the case of maxillary canines, amounting to 71.9 per cent as against 28.1 per cent.

This preponderance in the case of the female sex can probably be explained by the fact that the cranium of the female is smaller than that of the

male, with a consequent diminution of the face, and consequently of the jaws and the dental arches, so that it would follow that displacements of teeth would occur more easily than in the case of males.

The question could be asked, "Why is it that the canine only is involved in such displacements?" Perhaps the reason is that the canine stands just at the limit of the maxilla and intermaxillary bones, so that by differences of growth, or in first development (inheritance), the canine is more easily involved in this disturbance. The preponderance of the left side (50 per cent against 36 per cent and 14 bilaterally), consequently a proportion of nearly 3 to 2, I am unable to explain. Speculations concerning this matter are of little value. This field belongs to the orthodontist, who takes into consideration not the teeth alone, but the face and the whole cranium.

Table V gives a survey of the position of displaced maxillary canines between the buccal and the palatal sides, in other words, in the frontal plane.

TABLE V

SITUATION OF THE TOOTH BETWEEN BUCCAL AND PALATAL SIDES (IN THE FRONTAL PLANE)

Tooth buccally	11 = 15.0%
Tooth palatally	25 = 34.2%
Crown palatally, root buccally	21 = 28.7%
Crown buccally, root palatally	5 = 6.8%
Tooth normally, between buccally and palatally	11 = 15.0%
	73 = 99.7%

There are two points which are especially surprising. First of all only 15 per cent of the teeth are actually in the frontal plane, whereas 34.2 per cent are situated palatally, and 28.7 per cent exhibit a tendency to erupt palatally. If one takes these two numbers together, it appears in the case of displaced maxillary canines 62.9 per cent, or nearly two-thirds, have a tendency to erupt palatally. On the other hand only 15 per cent of the teeth are situated buccally, and only 6.8 per cent of the tooth crowns are directed buccally—this leaves only 21.8 per cent in the buccal direction. Therefore comparing the palatal tendency with buccal, the proportion of palatal to buccal is as 100 to 36.5 per cent, or 10 to 3.6 per cent.

The sagittal plane stands vertically to the frontal plane. The situation of the canine with regard to this plane must also be determined. Information concerning this point is found in Table VI.

TABLE VI

SITUATION OF THE TOOTH IN THE SAGITTAL PLANE

Normal position	14 = 19.1%
Oblique position	35 = 47.9%
Cross position	24 = 32.8%
	73 = 99.8%

The orthodontist can reckon that in a fifth of his cases (normal position, 19.1 per cent) no difficulty will arise; in almost half of his cases (oblique position, 47.9 per cent) difficulties will occur in regard to regulation; while in a

third of his cases (cross position, 32.8 per cent) only under exceptional circumstances can the displaced canine be brought into its normal position. I have only found a single case of a canine which was completely inverted, that is, turned through 180 degrees.

The following Table VII gives the percentage distribution with regard to displaced canines turned about the longitudinal axis:

TABLE VII

TURNING OF THE CANINE ABOUT THE LONGITUDINAL AXIS

At 15 degrees	1 = 1.3%
30 "	4 = 5.2%
45 "	1 = 1.3%
60 "	11 = 15.0%
90 "	16 = 21.9%

The correction of rotations between 15 and 45 degrees is relatively easy to bring about; besides, these as shown by my statistics are not frequent. Again rotations of 60 degrees, of which there are 15 per cent, can be dealt with by the orthodontist. Displacements through 90 degrees are, however, more difficult, and are more frequent than one might assume, the table showing 21.9 per cent of such cases.

Table VIII gives data concerning the tooth-sac—the transition to the follicular cyst and the follicular cyst proper.

It will be noted that here again conditions are not favorable, since 4.1 per cent of the cases show a transition to cyst, and in 5.4 per cent a follicular cyst is formed. Taking into account the whole pathology of the tooth system, the total of 9.5 per cent seems somewhat high. From the orthodontologic point of view this result cannot be considered satisfactory, nor are the cases of combination of displaced canines with follicular cysts, which amount to 2.7 per cent.

TABLE VIII

RADIOGRAPHICAL DATA REGARDING THE TOOTH-SAC

Not represented	19 = 26.0%
Distinctly visible (normal)	47 = 64.3%
Dilated (transition to cyst)	3 = 4.1%
Very much dilated (cyst)	4 = 5.4%
	73 = 99.8%
Combination with radicular cyst	2 = 2.7%

I have before drawn attention to the great preponderance of the female sex in such cases as are shown in Table IX. With regard to seven cases of displacement in the frontal plane, we note a certain correspondence. Two cases, however, show a different position, Case V being especially interesting. This case is illustrated in Fig. 20. In the sagittal plane we have only five cases of correspondence, while four are different. Case IV is particularly remarkable. This case, in which we have oblique and also a horizontally displaced tooth, would probably present difficulties to the orthodontic therapeutist. The ob-

served rotation of the teeth about the longitudinal axis would not present any particular difficulties. In almost all bilateral cases a tooth-sac is found on one side. Only one case—Case IX—is unfavorable because of a cyst, but Case VI is unfavorable because of the horizontal displacement shown. Seven other cases have an importance in orthodontics, because the displacement is bilateral. In the three cases (I, V, VII) the radiograph shows complications, so that from the radiographic point of view only four cases (II, III, VI, VIII) appear free from complication.

TABLE IX

STATISTICS OF NINE BILATERALLY RETAINED CANINES

		I	II	III	IV	V	VI	VII	VIII	IX	
Male		--	--	m.	--	--	--	--	--	--	1 male
Female		f.	f.	--	f.	f.	f.	f.	f.	f.	8 females
Frontal plane:											
Tooth buccally	r.	--	--	--	--	--	r.	--	r.	--	1 case
	l.	--	--	--	--	--	↑		l.	--	like
Tooth palatally	r.	--	r.	r.	r.	--	|	--	--	r.	4 cases
	l.	--	l.	l.	l.	--	|	--	--	l.	like
Crown palatally	rr.	--	--	--	--	--	|	r.	--	--	2 cases
Root buccally	ll.	--	--	--	--	l.	|	l.	--	--	like
Crown buccally	r.	--	--	--	--	r.	|	--	--	--	
Root palatally	l.	--	--	--	--	--	|	--	--	--	
Tooth normally	r.	--	--	--	--	--	↓	--	--	--	
	l.	--	--	--	--	--	l.	--	--	--	
Sagittal plane:											
Normally	r.	--	--	--	--	--	r.	--	--	--	1 case
	l.	--	l.	l.	--	l.	l.	--	--	--	like
Obliquely	rr.	--	r.	r.	r.	r.	--	r.	r.	r.	4 cases
	ll.	--	--	--	↑	--	--	l.	l.	l.	like
Across	r.	--	--	--	↓	--	--	--	--	--	
	l.	--	--	--	l.	--	--	--	--	--	
Turning of the tooth; longitudinal axis 60 degrees	r.	--	--	--	--	--	--	--	--	--	
	l.	--	--	--	l.	--	--	l.	--	--	2 cases
90 degrees	rr.	--	--	--	r.	--	--	r.	--	--	
	l.	--	--	--	--	--	--	--	--	--	3 cases
Distinctly visible tooth-sac (normal)		//	/	/	//	//	--	//	/	/	4 bilaterally 3 unilaterally
Cyst		--	--	--	--				--	/	

As one result of the data I have compiled, I wish to draw especial attention to the fact that symmetry in the case of canines which occur bilaterally can hardly be expected.

The scale of frequency proves that displaced canines in the maxilla are much more frequently found than in the mandible, the proportion being 20 to 1. It also appears that the number of displaced maxillary canines, which amount to 2 per cent, is rather high. Table X gives the numbers in the remaining cases.

TABLE X

In about 3,000 cases radiographed there were observed *displaced canines*—	
In the maxilla	62 = 2.06 %
In the mandible	3 = 0.1 %
In maxilla and mandible	2 = 0.066%
Displaced canines were *suspected in the maxilla* and *not found radiographically*	4 = 0.133%

TABLE XI

PATIENTS WERE SENT FOR RADIOGRAPHY	
Because of general dental symptoms with the question, Is the canine present?	42 = 65.6%
Because of orthodontic symptoms	7 = 10.9%
The displaced canine has been found clinically	15 = 23.4%
	64 = 99.9%

I have also compiled Table XI showing the percentages of patients sent for radiographs; and in regard to the symptoms, it is surprising to note that in 23.4 per cent of the cases, the canine was not sought but was found to a certain extent accidentally from other symptoms, upon the taking of the radiograph. This percentage is high, and goes to show that more care should be taken during examination to determine if a displaced canine is present. It is remarkable that in only 11 per cent of the cases was the radiographic investigation undertaken because of orthodontic symptoms. From the data I have compiled, showing certain cases and their relative values, it appears that in orthodontia a greater interest should be taken to determine if displaced canines are present.

I have collected my results and conclusions in the following summary:

(1) Assuming freedom from technical errors in the taking of a radiograph, a displaced tooth in the jaw will be the more distinct as to details of structure, and appear the more normal in shape, the nearer the tooth, or a portion of it, is to the film.

(2) The Hauberrisser method, where two radiographs are taken from different positions and combined (one close to the palate and the other in the occlusal plane), enables the position of a displaced tooth to be geometrically represented.

(3) The distances of a displaced tooth from points in its environment can be determined by means of the graduated measuring apparatus designed by Röhrer; this apparatus is introduced before taking the radiograph and its shadow projected onto the tooth film.

(4) The female sex shows a great preponderance of displaced canines in the maxilla, and curiously a preponderance also of displaced canines in the left jaw; the reason for this cannot be determined. Again, in the female sex there is also found a greater number of cases of bilaterally displaced canines; this is probably due to the smaller construction of the face and jaws in the female.

(5) In the frontal plane only 15 per cent of displaced canines are situated normally. A comparison of the erupting tendency of maxillary displaced canines gives, palatally to buccally, 10 to 3.6 per cent.

(6) In the sagittal plane, maxillary displaced canines, in almost half the cases, are obliquely situated, and in one-third of the cases transversely.

(7) Rotation up to 45 degrees about the longitudinal axis in maxillary displaced teeth is not very frequent; rotations of 60 degrees and 90 degrees are more frequent, as might be expected as they constitute one-third of all the cases.

(8) In one-fourth of the cases concerning displaced maxillary canines, the tooth-sac is not present; in two thirds of the cases it is normal. Transition of the tooth-sac to follicular cyst, and duly developed follicular cysts, are found in the high percentage of 9.5 per cent.

(9) Symmetry in the case of bilaterally displaced maxillary canines cannot be expected.

(10) Displaced canines are much more frequent in the maxilla than in the mandible—the proportion being 20 to 1.

Alpha Omega Fraternity

The Twenty-second Annual Convention of the Alpha Omega Fraternity will be held in Philadelphia, December 23, 24, and 25, 1929. Headquarters, Benjamin Franklin Hotel.—Wm. Ersner, Chairman, Convention Publicity, 1915 Spruce Street, Philadelphia, Pa.

DEPARTMENT OF
ORAL SURGERY, ORAL PATHOLOGY AND SURGICAL ORTHODONTIA

COMPOUND FOLLICULAR ODONTOMA OF THE MAXILLARY SINUS

By Sterling V. Mead, D.D.S., Washington, D. C.

NAME: T. T.

Age: 24 years. Sex: Female. Born: District of Columbia.

Occupation: Teacher.

Duration of present illness: 6 months.

Personal History.—Patient had the usual diseases of childhood with uneventful recovery. There was no history of previous operation. Patient did not use alcohol or habit-forming drugs.

Present Illness.—Patient had impacted third molar extracted about six months before and had suffered excruciating pain ever since. The right side of the face was badly swollen, and the cheek in the region of the malar process seemed to be quite distended.

Physical Examination.—Fairly well developed female. Heart and chest essentially negative. Face greatly swollen, firm and very painful. Temperature 102.3° F. Pulse pressure 110. Respiration 26.

URINE	BLOOD
Color: amber	Wassermann: negative
Reaction: acid	Red cells: 4,200,000
Specific gravity: 1.022	Leucocytes: 10,500
Albumin: negative	Coagulation time: 5 minutes
Sugar: negative	
Blood: negative	
Pus cells: negative	

The patient presented herself at the hospital on June 28, 1929, with a temperature of 102° F., and the right side of the face was badly swollen and eye nearly closed. The swelling over the cheek was very hard, and painful to pressure. There was no involvement of the lymph glands of the neck. Lateral

Fig. 1.—Photograph showing swelling on right side of face.

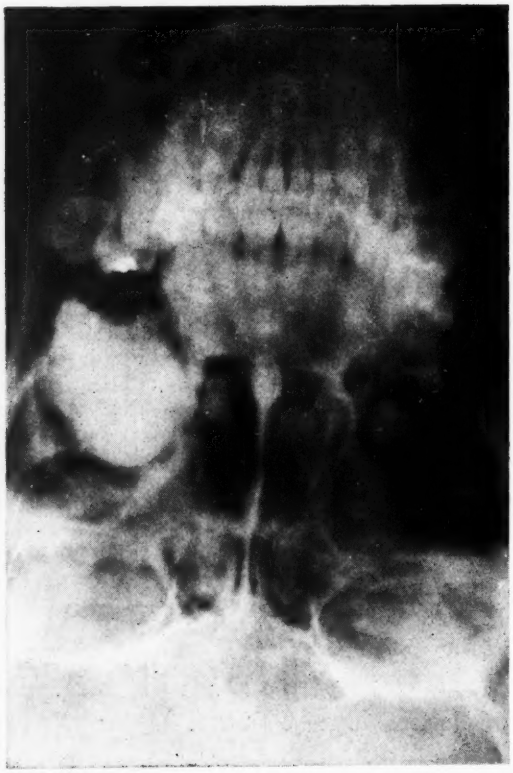


Fig. 2.—Anteroposterior extraoral roentgenogram showing radiopaque object in right maxillary sinus, surrounded by small radiolucent area.

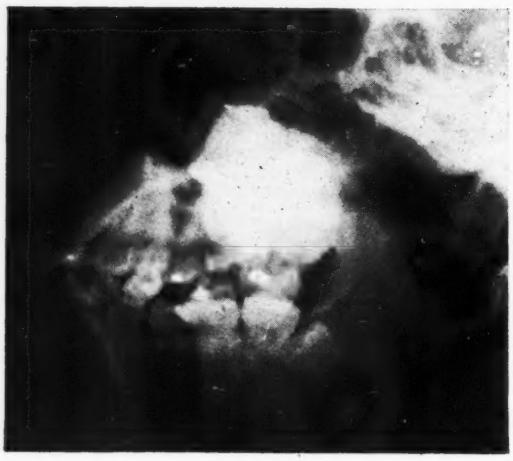


Fig. 3.—Lateral extraoral roentgenogram showing radiopaque object.

and anteroposterior roentgenograms disclosed a radiopaque object which completely filled the right maxillary sinus. A presumptive diagnosis of odontoma was made which was later confirmed at the operation.

On June 29 the patient was put under nitrous oxide and oxygen anesthesia, and an intraoral incision was made at the reflection of the cheek and the alveolar process in the region of the first maxillary molar for drainage of acute cellulitis.

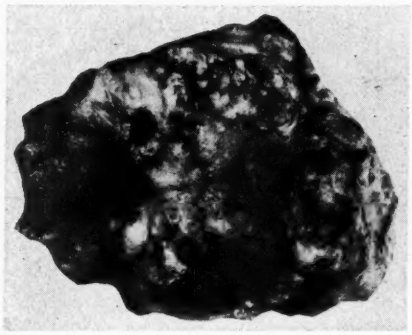


Fig. 4.—Gross specimen of growth removed. The mass was hard and dense, with uneven periphery, and apparently made of a mass of tooth follicles and a conglomerate mass of tooth structure.

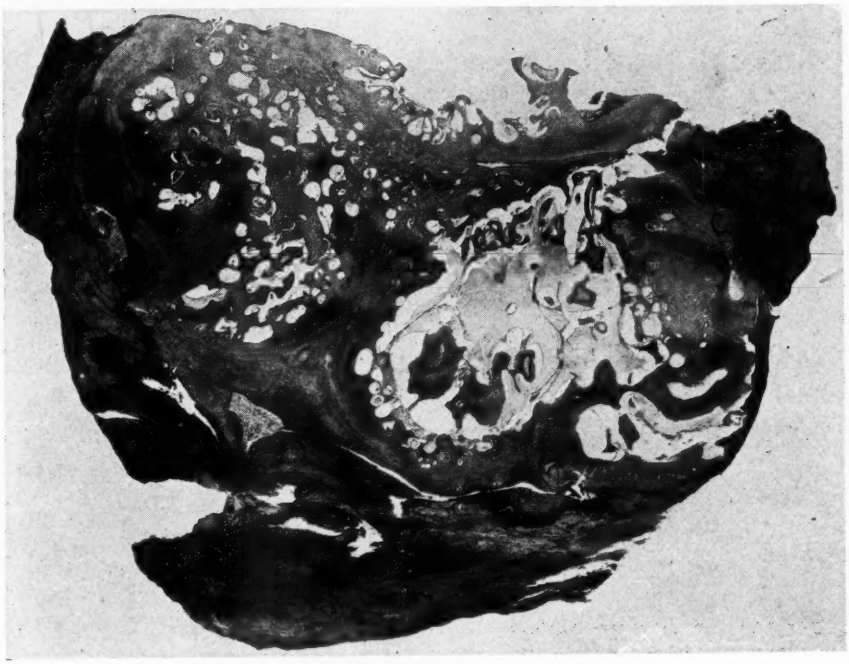


Fig. 5.—Photomicrograph x20.

As the pus had also pointed to the outside of the face, an incision was also made over the malar process. It was necessary to incise again on July 10, 1929, and the swelling then quickly subsided after proper irrigation and drainage.

On July 18, 1929, the patient was again operated under nitrous oxide and oxygen anesthesia, and an incision was made in the mouth on the buccal surface from the bicuspid area over the crest of the alveolar process to the tuberosity

region, and the soft tissues retracted and the growth removed in one piece from the maxillary sinus. The soft tissues were then sutured across with silk suture, and an intranasal puncture was made through the inferior turbinate and the sinus packed with iodoform gauze. This gauze was changed in 48 hours and

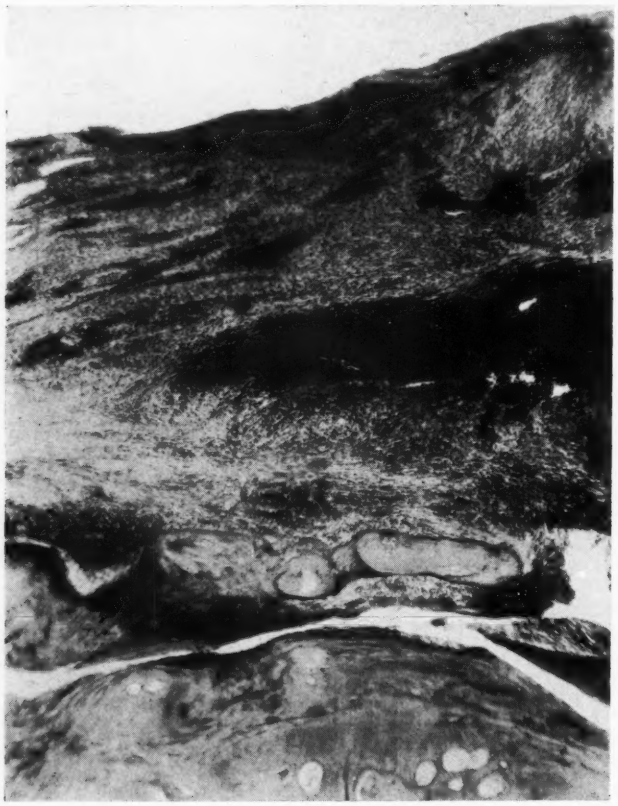


Fig. 6.—Photomicrograph x90.

then daily for seven days, and the sinus irrigated daily until the mouth wound had completely healed. The patient was discharged from the hospital on August 4, 1929, as completely recovered. The postoperative diagnosis was compound follicular odontoma and confirmed the preoperative diagnosis of odontoma.

IMPACTED CUSPID OPERATION

Report of a Difficult Case

By M. Hillel Feldman, D.D.S., New York, N. Y.

THERE is an endless variety of types of impacted cuspids, but the most treacherous, from the standpoint of danger of fracture of the jaw, is that condition such as shown in the accompanying roentgenograms where the tooth lies in close relationship to the lower border of the mandible.

Fig. 1.—Lateral view of jaw with impacted cuspid lying at the inferior border of the mandible.

In this instance the danger of jaw fracture was enhanced by reason of there being present a large cyst extending from the gingival border of the jaw to the lower border.

My approach to the tooth was made by means of the bi-bevel spear drill. Small portions of bone were removed thus slowly until the outer plate covering the tooth was removed.

Fig. 2.—View of impacted cuspid taken with the patient's head and chin slightly turned from the usual position for posteroanterior view in sinus examination. Crown is shown at lower border of jaw.

Fig. 3.—Postoperative view of case shown in Figs. 1 and 2.

I then drilled into the tooth at the junction of root and crown. With slight mesiodistal leverage the crown was elevated. The drill was then inserted into the root, and with the gentle lever action of the delicate Field Pathfinder, an instrument somewhat similar to the Crane Pick, the root was moved forward into the space created by the vacating of the crown.

I fully believe that a chisel-mallet technic would have fractured the jaw. My technic of the drill has made it possible for me to perform many operations which under ordinary circumstances might result in more than comfortable postoperative effects.

CHIEF FUNCTION OF NASMYTH'S MEMBRANE

By Dr. William L. Shearer, Omaha, Neb.

SO FAR as I know articles on Nasmyth's membrane have been written and reported from time to time. In these articles Nasmyth's membrane has been given no particular function and has been reported by many as having no function.

Nasmyth's membrane has a definite function. It acts similar to the bag of waters in the birth of a child. The bag of waters dilates the canal and the head is born. This same thing is true of the Nasmyth's membrane. By pressure of the membrane against the bone it absorbs the bone and gives birth to the crown of the tooth, and the tooth is born or erupted into the mouth. This, in reality, is its important function. While it has other functions, this is the major one.

REPORT OF A CASE OF MANDIBULAR CYST

By Dr. Ernest A. Morris, Houston, Texas

FEMALE, Negro, weight 300 pounds, thirty-five years old, single, had been married.

At the age of eighteen, patient was confined to bed for twenty-six months with rheumatism and was unable to walk for several weeks thereafter. She

Fig. 1.—Intraoral, extraoral, and occlusal views of mandibular cyst.

had suffered intermittent rheumatic pains from that age until now. September, 1928, patient was again confined to bed with same condition as evidenced at age of eighteen, but the pains were more severe in legs and arms. She had examination and medical treatment but got no better.

Evidently examination was only superficial, for on March 9, 1929, a Negro dentist was called on the case, and he found a large mandibular cyst with embedded second molar in cyst and an impacted third molar not involved in the cyst. He insisted on complete blood and other examinations. Patient

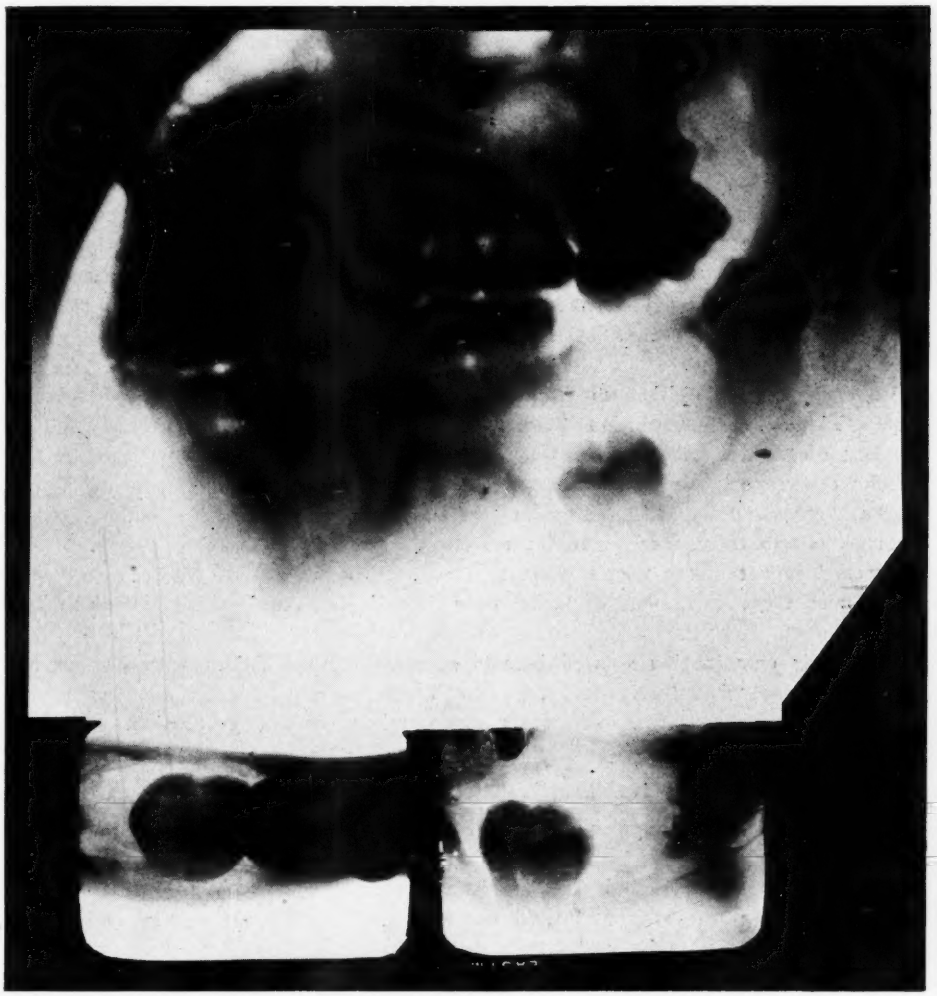


Fig. 2.—Intraoral, extraoral, and occlusal views of mandibular cyst, showing absorption of roots of first molar.

showed a four-plus Wassermann. Urinalysis showed normal except for many epithelial cells. Case was put on luetic treatment March 11. Cyst was operated June 28. Entire buccal plate was gone except for inferior border. There was no fracture. There was partial anesthesia of lips which two weeks later was already leaving.

CASE REPORTS

By Dr. George W. Christiansen, Detroit, Mich.

CASE 1.—Male, white, 56 years old, was admitted to surgery May 11, 1928. Pain in left side of face since January. At that time he had toothache and had a tooth removed, following which an abscess developed. This eventually ruptured through the cheek, following which pain subsided. Since that time more or less swelling has been present.

Examination shows white male, fairly well nourished, with left cheek swollen and suppurating. The soft tissue was very firm and deeply indurated. Intraoral examination revealed a lesion, perforating hard palate in left maxillary molar region extending into the antrum. The borders of lesion were ragged with appearance of leucoplakia extending across the palate. X-ray examination showed left antrum, increased in density and the outline indistinct.

Two specimens of epithelium from border of lesion showed marked hyperplasia with infection. There was granulation tissue reaction in submucosa, and the lymph vessels were widely distended, but there was no evidence of malignancy.

Under ether anesthesia the remaining teeth in the left maxilla were removed, the osseous support having been destroyed. Tissue destruction involved left maxilla, malar, left palatal bone, vomer, nasal septum and entire antral floor. The area was thoroughly curetted, and many loosened inflammatory masses were removed.

Specimens from area, some of which were necrotic bone and others fibrous tissue, were examined.

Microscopic examination showed islands of stratified epithelium with growth impulse. There were local areas of foreign-body, giant-cell formation.

Recovery was uneventful. Diagnosis was carcinomatous degeneration.

Case 2.—Female, white, 45 years old, was referred for treatment of trench mouth. Clinical examination showed a generalized gingivitis with areas resembling mucous patches. Smears made on several successive days failed to show a true picture of Vincent's infection.

These patches were treated daily with numerous drugs, such as mercurial preparations, dyes, potassium arsenitis and mild antiseptics. Healing apparently took place, but other patches appeared near by.

A general physical examination was advised, and the major finding was a marked vaginal discharge. No definite diagnosis was made, but the patient was hospitalized. Shortly after this, areas of skin where folding occurred, such as neck and lower abdomen, began to open with the formation of small fissures. These healed and others formed in the adjacent tissue.

The patient's general condition grew worse with loss of weight and extreme pallor. Following two months of hospitalization, patient died. Diagnosis was pemphigus.

SOME PHASES OF MOUTH INFECTION AS RELATED TO SYSTEMIC DISEASE*

By R. C. Matteson, D.D.S., Sioux City, Iowa

DURING the last several years articles have frequently appeared in medical and dental literature stating that a close relationship exists between chronic oral infections and certain systemic diseases. The findings of many noted investigators, in both medical and dental professions, and our clinical experience have caused us to realize the seriousness of this relationship and to accept the teachings of these men upon the systemic effect of these chronic oral infections.

In following out these teachings in practice we have had many gratifying results and much benefit to the patient, but we have also had our disappointments and seeming failures. It is not my intention to try to cover the whole subject of oral infection at this time, but to point out one or two phases of it where I think we may have failed to recognize a focus that has defeated our efforts in cleaning up oral infection. There is no doubt that a great deal of judgment is required in making a diagnosis and deciding on the proper procedure in many of these cases. The radiograph and its interpretation enable us to recognize gross pathology but oftentimes are not of much assistance where we are concerned with the primary focus, which is usually very small. Dr. Mackenzie of Philadelphia in a recent article on focal infection stresses this point, and you will pardon my quoting him. The bases for his conclusions on the subject are as follows:

1. "That a focus of infection in any part of the body will, under certain conditions, give rise to pathologic changes in some other part, often quite distant from the primary focus."

2. "That the primary focus is usually a small one such as is found at the apex of a tooth. A large area of infection is more prone to spread to the surface with resultant drainage."

3. "That the character of the infection at the primary focus is not severe enough to cause a general breaking down of the tissues, such as occurs in acute abscess formation, which tends to rupture and discharge on the surface or break inwardly into one of the vital cavities with resulting complications."

4. "That the circumscribing process, which results in limiting the infection to a small focus, is due to the natural resistance of the host in walling off the infected area, primarily with lymphocytes."

5. "That it is not so much the bacteria themselves as their toxins which give rise to the secondary manifestations, for how could the very rapid improvement which so often follows the removal of the primary focus be otherwise explained. Overnight improvement in the case of severe neuritis is not

*Read at joint meeting of the Woodbury County Medical and Dental Society, Sioux City, Iowa, April 25, 1929.

so uncommon. In the case of the sciatic nerve a complete disappearance of all pain has been observed to occur within a short time after the removal of an infected tooth.''

6. ''That the pathologic findings of the so-called rheumatic group, as characteristic of the productive form of inflammation with the typical, small, round cell infiltration, so common to it, and the absence of bacteria as further proof that the secondary manifestations are of purely toxic origin.''

7. ''That clinical experience proves conclusively that bacteria locked off from air or oxygen, pile up a virulency after many hours, which permits them to produce toxins having a selective action for a particular tissue, and that ventilation of the focus causes that virulency to subside.

Now granting the above to be true we see the importance of cleaning up any and every focus, and I wish to demonstrate in my following remarks one or two instances where we cannot rely entirely on our interpretation of the radiogram for our proper procedure. First, I wish to call your attention to the group known in dentistry as unerupted, impacted and imbedded teeth, or to be more specific impacted imbedded teeth, a tooth hindered in its eruption resulting in its being wholly surrounded by bone after the period of full maturity. The partly erupted impacted tooth is one having a part of its crown emerging through the bone—usually communicating into the mouth. This is the tooth with the overlying flap of soft tissue, making a beautiful culture media for bacteria, resulting in the local symptoms you are all familiar with. There is usually no doubt as to its removal.

The conditions found may be classed under two headings: (1) conditions where we have inflammatory reaction and tissue change; (2) the neuralgias and different forms of neurosis.

Some of the most common conditions found in the first class are: acute and chronic alveolar abscess, cysts, osteomyelitis, necrosis, peritonsillar abscess, iritis, etc., with the usual symptoms of inflammation—pain, swelling, redness, impaired function, temperature of 100° to 103° F., headache, lumbar pains, stiff neck, troubled sleep, etc. In the second class we find nervous and mental disturbances with no inflammatory symptoms. Pain may be slight or severe, and it may be intermittent, periodical or constant. It may be localized but is often distributed along both dental branches of the trifacial nerve. There may be pain or impaired function at other places remote from the focus.

A number of noted investigators, such as Drs. Cotton, Walker, Sawyer, Young, Upson and others, have demonstrated and placed much stress on the relationship between diseased or impacted teeth and certain mental and nervous disturbances not directly associated with brain lesions. This type is known as functional psychosis or neurosis, and there is no organic degeneration of the central nervous system. Among the many causes are the irritations of diseased or impacted teeth.

Whether we should always remove the impacted, completely imbedded tooth has been a debatable question with dentists. The x-ray findings are often negative, and there may be few if any local symptoms. It would seem that these are normal teeth, they are not decayed, have vital pulps, and there is

no communication into the mouth. So we may easily conclude to pass them as a focus and consider only their possible irritation through the nervous system because of their position. Unerupted teeth impinging on neighboring teeth are severe irritants, and if there is a breaking down of the surrounding tissue or injury caused the adjoining tooth, it of course becomes a focus. Recently there has been some interesting research work on the pulps of unerupted teeth by Drs. Upson, Cotton and Cahn. Their findings are very interesting. They report finding calcified areas within the pulp, round cell infiltration and fatty degeneration. Dr. Cotton reports most of the cultures made from the pulps were streptococcus. These findings, of course, indicate a focus of infection and are very interesting, because these teeth were sound teeth, not decayed, and with vital pulps.

It has sometimes been hard for me to decide on the proper procedure in these cases, and after reading the report of these investigators, I decided to check up with the help of Dr. Starry on the pulps of unerupted teeth we removed. During the last year Dr. Starry has run quite a long series of them and I have asked him to give you his findings and opinions as related to focal infection. Also he cultured the pulps of a series of teeth with large fillings, teeth with vital pulps but with fillings in very close proximity to the pulp. These teeth had been filled a number of years and the x-ray findings were negative. Dr. Starry reported a positive culture in about 50 per cent of the filled teeth and about 60 per cent of the unerupted teeth and usually a pure culture of either streptococcus or staphylococcus.

CONCLUSIONS

From my observation of the results obtained, following the removal of unerupted teeth, I have come to the conclusion that if unerupted teeth cannot be placed in their normal position before maturity, they should be removed. They should be removed as early as possible so as to avoid the conditions under discussion this evening. They should be removed as early as possible because the operation is easier for the young patient—the bone being less calcified.

Now as to teeth carrying the large fillings, if the symptoms held to be due to focal infection continue after all localized areas have been cleaned up and healed, and you have been assured by a competent diagnostician that no other areas do exist, you may look with suspicion on vital teeth with large fillings closely approaching the pulp, and you are justified in removing them.

*Dr. Allen C. Starry.**—Examination of all teeth submitted was done as follows: The tooth was placed in alcohol 95 per cent after plugging apex of root canal with sterile paraffin. The tooth was then broken open in sterile gauze and cultures made from the pulp. Cultures frequently revealed Staphylococcus pyogenes albus or aureus, with an occasional streptococcus. However, the staphylococcus predominated.

*Allen C. Starry, M.D. Director, Department of Clinical Pathology, St. Joseph's Mercy Hospital, Sioux City, Iowa.

I believe that in most of these cases these organisms had a definite bearing upon the general health of the patient and was the direct cause of certain toxic and infective changes.

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DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

Edited By
Clarence O. Simpson, M.D., D.D.S., F.A.C.D.,
and Howard R. Raper, D.D.S., F.A.C.D.

EXTRAORAL RADIODONTIC EXAMINATIONS

By Dr. Clarence O. Simpson, St. Louis, Mo.

THERE is a common misconception in considering that easy acts are too difficult to undertake or in believing that intricate tasks are so simple that failure is not realized. Many persons have the ability for accomplishments which are never attempted because they lack self-confidence, and far more choose vocations for which they are unqualified. Prevalent misconceptions regarding radiodontia are that special skill is required for extraoral examinations but that only a machine is needed for intraoral examinations. Probably this erroneous impression is due to the more extensive field covered and to the larger films used in extraoral examinations. There is a subconscious suggestion that it is more difficult to make a large picture than a small one. The usual extraoral view does not demonstrate any less proficiency than other radiographs by the same operator but only appears worse because there is more of it.

In fact, extraoral examinations are comparatively easy and might be more appropriately selected by those who have an ambition to standardize other phases of radiodontia. For intraoral examinations, there are difficulties encountered in placing the film packets correctly, and the angle of projection must be calculated for each region. In extraoral examinations, the region to be radiographed is usually placed against the cassette, and the rays may be directed at the same angle for most regions. This leaves as the variable factor the pose of the head, which is visible and readily adjusted.

Judging from some examples, the indications and contraindications for extraoral examinations are not recognized by many dentists. The indications may be summarized as being for the examination of regions which cannot be registered upon intraoral films in the desired perspective. Any part of the face might be registered upon intraoral films, but there are restrictions in the placement of film packets to secure a diagnostic view of all parts of the maxillae and mandible. The restrictions vary with anatomic and pathologic conditions and the tolerance of patients, and can be modified by dexterous manipulation of the packets. The average limits to intraoral views of desirable

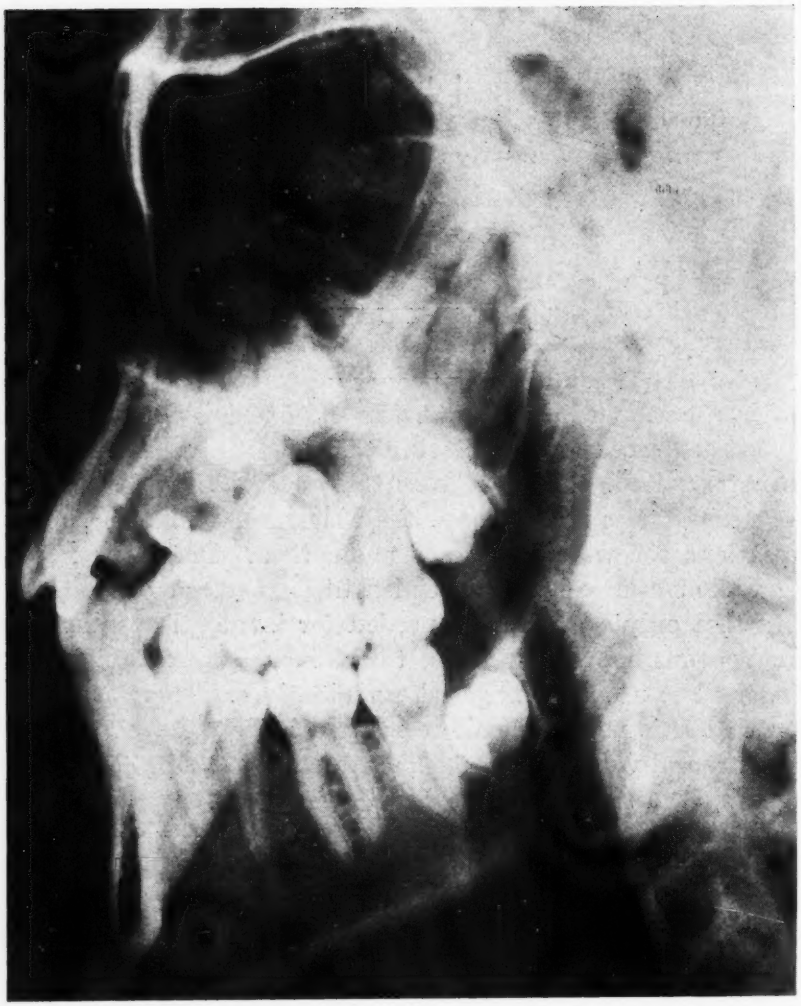

Fig. 1.—An extraoral view of normal structures with partially developed third molars. In this pose all of the molars on the right side, the retromolar regions, and the approximate relation of the right second and third molars are revealed. The cervical vertebrae are superimposed on the ramus, the pharnyx produces a radiolucent zone across the mandible in the third molar region, the uvula registers as a slightly radiopaque streak below the maxillary third molar, and the bones and teeth on the left side are projected upward and forward from the first molar. The large triangular radiolucent area is the left maxillary sinus. If the pose or direction of the rays were changed to reveal the bicuspids, the vertebrae would be superimposed near the third molar, and the relation of the second and third molars would be misrepresented by a partial superimposition of these teeth.

perspective are slightly beyond the apices of the teeth. In the mandibular molar regions it is generally possible to obtain an undistorted image to the lower border of the mandible. In the mandibular incisor and cuspid regions and most maxillary regions the structures beyond the roots of the teeth must be foreshortened to avoid distortion. Foreshortened images are unreliable for diagnosis or localization, and because the fault is not so evident they may be more misleading than elongated images.

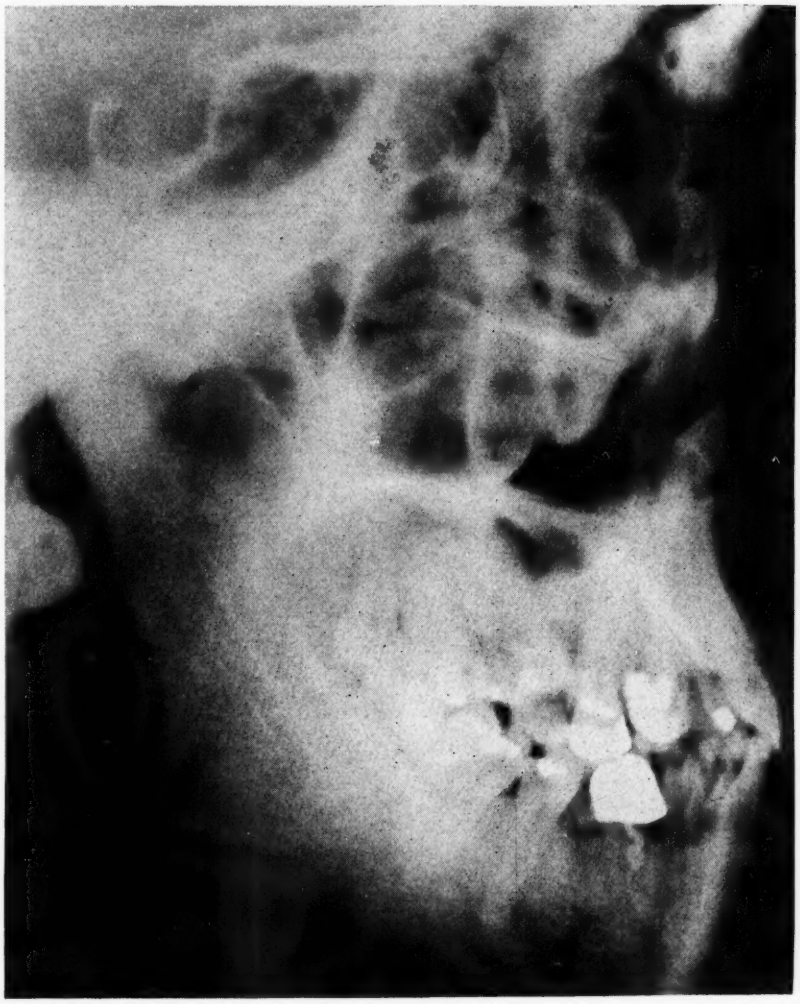

Fig. 2.—An extraoral view in a profile aspect to reveal a misplaced tooth which was erupting into the nasal fossa. Lateral localization was unnecessary because the cusp was visible, and the tooth was removed through the anterior nares. This is not a true profile view as the rami are superimposed instead of the malar processes.

The specific indications for extraoral examinations are: (1) extensive pathologic areas which are not conclusively covered by intraoral examinations; (2) suspected fracture, because the rami and condyloid processes are susceptible to traumatic injury; (3) disturbances of obscure origin as a process of exclusion; (4) misplaced teeth which are to be localized; (5) maxillary sinus inspections; (6) broken syringe needles and other foreign objects which are to be removed; (7) children and hypersensitive patients who will not

Fig. 3.—A profile view for the localization of a misplaced tooth which was discovered but could not be localized by intraoral examination. This view shows the anteroposterior and superoinferior location of the tooth as the anterior wall of the maxillary sinus, but further examination is required to establish the lateral location and position. A notable anatomic feature is the absence of frontal sinuses in the vertical portion of the bone and only a small cell in the horizontal portion. The radiolucence of the pharnyx is less marked but no less confusing than in Fig. 1, since it obscures the angle of the mandible nearer the film and suggests a fracture at the base of the condyloid process. The uvula is superimposed toward the angle of the mandible as are the styloid processes of the temporal bones.

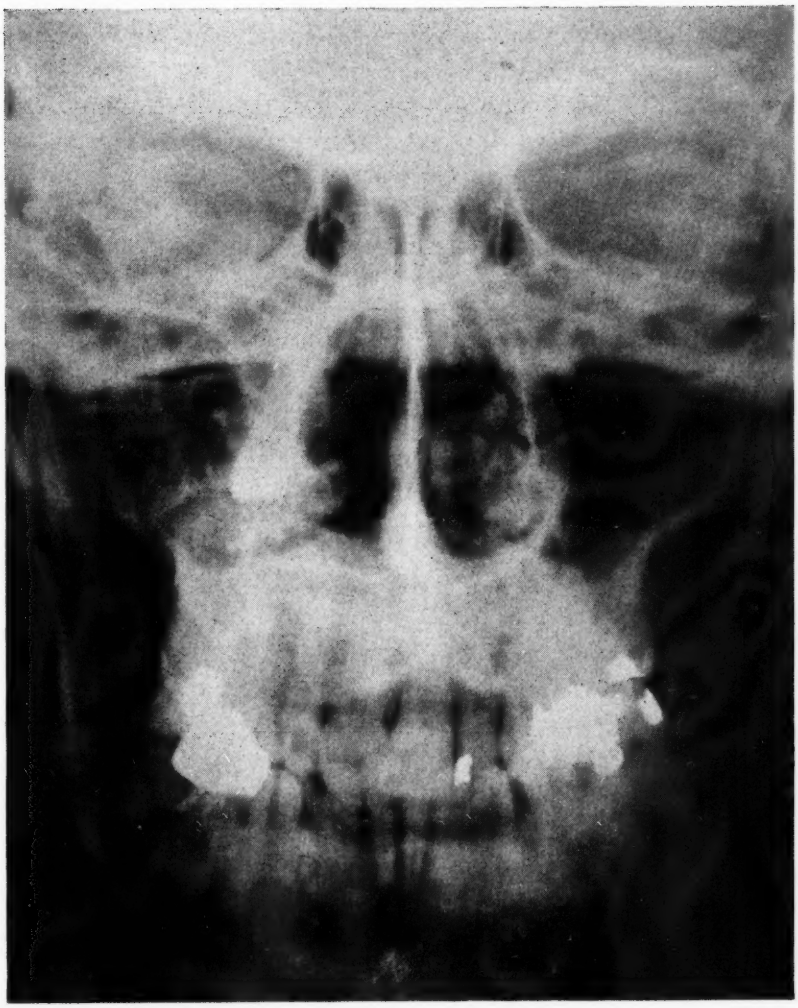

Fig. 4.—An extraoral view in the sagittal plane to determine the lateral location of the tooth shown in Fig. 3; the location proves to be the internal or nasal wall of the maxillary sinus. The radiopacity of this maxillary sinus in comparison with the other indicates a pathologic involvement for which the tooth may be responsible. The tests for the accuracy of a view in the sagittal plane are the sharp image of the vomer and the equality of the triangular spaces between the mandible and maxillae.

a. *b.*

Fig. 5.—The localization of a misplaced tooth below the mandibular incisors. (*a*) The ordinary lingual view indicates that the cusp of the unerupted tooth is only 6 millimeters from the apices of the lower incisors. This evidence must not be accepted without verification because the labiolingual relation is not disclosed, and the angle of projection is likely to misrepresent the superoinferior relation. (*b*) An occlusal view shows that the cusp of the unerupted tooth is at least 15 millimeters from the apices of the incisors, and the tooth is erupting through the anterior surface of the mandible. It might be assumed that the superoinferior location of the misplaced tooth had been determined by the lingual view, but it has not until an extraoral examination is made.

tolerate film packets in the molar regions; (8) trismus or conditions which prevent the intraoral placement of film packets. Some operators routinely include two extraoral views with a general radiodontic examination, but statistics have not been presented to prove that this procedure is warranted when no special indication exists. As an extreme precautionary measure it is commendable, but as a premium attraction the time and effort could be more beneficially expended in the thoroughness of the intraoral examination. The

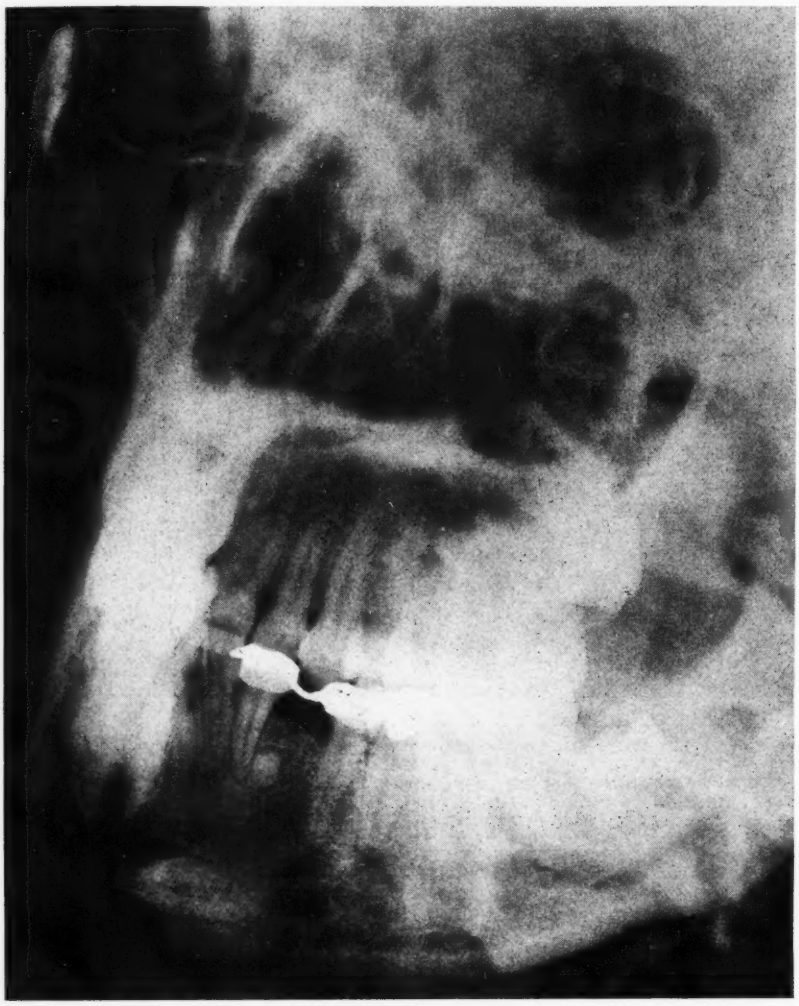

Fig. 6.—An extraoral view of the unerupted tooth shown in Fig. 5 by which the supero-inferior location of the tooth is established near the lower border of the mandible with the cusp 17 millimeters from the apices of the incisors. This example illustrates the fallacy of localization by the ordinary intraoral examinations and the indications for occlusal and extraoral views. The pose for this view is also useful for inspection of the malar process and malar bone which are shown in the upper left corner. The distortion in other regions, especially the molar regions, is marked.

general contraindication for extraoral examinations is when conditions permit of the essential information being secured intraorally with sharper definition of the images. This conclusion seems obvious, yet distorted, mysterious extraoral views are often seen of regions which could be clearly revealed by placing the films in the mouth.

(To be continued.)

ABSTRACT OF CURRENT LITERATURE

ORTHODONTIA — ORAL SURGERY — SURGICAL ORTHODONTIA
DENTAL RADIOGRAPHY
BY DR. EDWARD PREBLE, New York City

NUTRITION AND PEDIATRICS
BY SAMUEL ADAMS COHEN, M.D., NEW YORK CITY

It is the purpose of this JOURNAL to review so far as possible the most important literature as it appears in English and Foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

Orthodontia, Oral Surgery, Surgical Orthodontia and Dental Radiography

Logic and the Pulpless Tooth. T. P. Hyatt (New York). Dental Items of Interest **51**: 6, 1929.

The author, while his preventive odentectomy is held to be a radical measure, is conservative in his views regarding the pulpless tooth. He does not believe in routine extraction and the mere coexistence of pulpless teeth with neuralgia, etc., and even the fact that the latter may disappear after extraction of such teeth furnishes no absolute proof of a causal relation. The pulpless tooth has been given such a bad name that everyone inclines to be afraid of it. This attitude must be met with statistics and logic. Has anyone compiled hundreds of cases of neuralgia with reference to the condition of the teeth? Has anyone ever isolated two companion groups of pulpless teeth with and without neuralgia? Or of neuralgia with or without pulpless teeth? Removal of these teeth often fails to cure neuralgia, but not much attention is paid to these negative cases. The profession and public are under great obligations to W. A. Price for his effort to show that when infected teeth cause neuralgia, etc., the blood counts should show some evidence of a systemic infection. The author has seen recurrent furuncles disappear after extraction of pulpless teeth but refuses to be stampeded by such isolated coincidences. Which caused the other, the boils or the diseased teeth? We must be candid and admit that we are at present all up in the air concerning pulpless teeth and their power to cause disease at remote localities. It is true that extraction of such teeth has never been known to injure the general health, even perhaps though it interfere with mastication —this too should be freely admitted. Let us keep open minds and encourage the accumulation of more data before we arrive at a final opinion.

Orthodontia as a Separate Specialty. Pacific Dent. Gaz. **37**: 8, 1929.

Last autumn, legislative committees from two California state dental associations were formed to investigate legislation intended to dissociate ortho-

dontia from dentistry. No final report has yet been made as the committees desire more time for consideration. In the meantime the state of Arizona, with only three practicing orthodontists, has gone ahead and passed a law which makes orthodontia a separate profession. The practitioner must of course conform to the provisions of the new law. In California at least the opposition to this course is marked, and the orthodontists themselves among the first to object. There is no attempt to define dentistry, and the same reasoning might be used to separate oral surgery from dentistry in the narrower sense. The editor does not state who are the sponsors of the movement but does point out that they have overlooked important features which would probably end by making such a law ineffective or unconstitutional. Preventive orthodontia is one thing which might stand alone, but who can draw the line between operative orthodontia and ordinary operative and prosthetic dentistry? A letter is published in full from Dr. James D. McCoy attacking the Arizona law, from which it appears that an orthodontist, Dr. J. Howard Furby, is the spokesman of those who are urging the new legislation for California, but it does not appear that the latter represents any of the orthodontia societies. The national society, American Society of Orthodontists, has a committee which is now considering the subject, and it seems wise to await their verdict before attempting any more legislation. The Arizona law is far too long to quote even in abstract, but the provisions are naturally of the same sort as are found in all bodies requiring state licensure.

Precancerous Lesions in the Oral Cavity. J. C. Bloodgood (Baltimore). J. Am. Dent. A. **16:** 8, 1929.

Dr. Bloodgood, who as is well known has devoted many years to this subject, believes that the dentist of the future will be the means of saving thousands of lives, by pointing out to his patients that they have lesions in the mouth which promise an ultimate transformation into cancer, and by persuading them to have such lesions removed at once by the surgeon. First the dentist himself must be specially trained to recognize the lesions in question. These fall under two great classes—one a local and circumscribed lesion which may be a wart, a sore, a patch of leucoplakia, etc., and the other a more generalized process such as a glossitis, a stomatitis, etc. The first group as a purely surgical condition is to be attacked by the knife or cautery, and the tissue removed is to be examined under the microscope. If cancer is evident, then a good job has been done, and the outlook for permanent cure is good; if the lesion proves benign, no harm has been done, and a possible menace has been removed. If a generalized process is present, the cause must be sought and general treatment instituted; the menace of cancer is not so direct in this group, but prolonged irritation of any sort may in time give origin to malignancy. Many of the more unusual lesions of the mouth have never been known to cause cancer, but this does not mean that they may not exceptionally do so. Although Bloodgood does not so state, it seems evident that the modern oral surgeon should be well able to take charge of these pre-

cancerous lesions, although owing to the severity of advanced cancer of the oral cavity the general surgeon is usually the operator. But the one who should be the first to detect these lesions is the ordinary practicing dentist, who would naturally refer a patient to an oral or general surgeon.

Does Normal Dentition Cause Symptoms? Editorial, Dental Cosmos **71**: 8, 1929.

The title of the editorial in question is "A Medical Diagnostic Blind Spot." The subject is often debated in pediatric literature but is seldom to be met with in dental journals because the dentist does not come in contact with the teething infant. The discussion as to whether ordinary dentition causes pathologic symptoms is very old and apparently aggravated greatly by a confusion of terms. Both factions may be right, for, if dentition is normal, there should be no marked symptoms beyond the slight local irritation, and if pathology develops, we can simply state that the dentition is pathologic. The pathology in these cases consists chiefly of various reflexes not ordinarily seen in teething. If during dentition the infant develops some unusual malady, like convulsions, one should certainly take under advisement the possibility that the latter are of reflex origin. In such cases there should be either an unusual degree of nervous reactivity or some unusual local condition due to irregular development. No one doubts that in abnormal dentition in the older subject in connection, especially, with anomalous eruption of the third molars, many severe reflexes may develop including insomnia, reflex epilepsy, etc. The late Henry S. Upson, who wrote a monograph on this subject, left a fund for the study of dental reflex pathology, and up to 1917 over 2000 cases had been found recorded in literature in which a connection was shown between dental disorders and nervous ailments. The editorial closes with the suggestion that a dentist may at times be called in to inspect teething children with symptoms possibly due to dentition. For one thing the possibility of a local infection should be excluded.

Nutrition and Pediatrics

Further Studies on Thyroid and Hair Growth. Hsi-Chun Chang and Teh-Pei Feng, Chinese J. Physiol. **3**: 1, 1929.

Chang and Feng, as a result of experiments on albino rats at the Peking Union Medical College, Peking, consider the thyroid secretion the most important factor controlling the growth of hair.

They observed that by underfeeding these animals they were able to retard the growth of hair. But if these underfed rats were given thyroid in proper doses, their hair may grow at nearly normal rates, while if thyroid is given in excess, hair growth will be depressed.

It is interesting to note that these investigators found that in normal animals the administration of thyroid may retard or depress the growth of hair.

Observations on the Coincidence of Endocrine Dystrophies and Mental Subnormalities. Williams G. Douns, Jr., Annals of Internal Med. **2**: 8, 1929.

A very large percentage of the patients in any institution for the care of mental defectives shows evidence of internal glandular disturbance. Clinical and laboratory evidence is convincing that the glands such as pituitary, thyroid, testes, have a powerful influence over the psychic development and change.

The author wisely points out that while one single gland is held responsible for certain changes, it should be borne in mind that though this one particular gland may be of primary importance, the other glands are also involved and may likewise be the causative factor.

Douns, in reporting his observations of a series of 21 cretins, found the intelligence quotient of these patients to vary between the limit of 35 to 65 per cent (Benet). He also examined 38 mongols and found them to be of a lower order, their range showing an intelligence quotient between 15 and 45 per cent.

Contrary to his expectations, he found on the whole that the patients having a delayed sex development had a higher intelligence quotient than do those having a pathologic advanced stage of sexual development.

The Parathyroid Glands. E. Larson, Clin. Med. & Surg. **36**: 3, 1929.

Larson briefly reviews the literature of the parathyroid glands which were discovered by Sandstrom, the Swedish anatomist in 1880. MacCollum and Voegthin in 1909 were the first to report a lower calcium content in the blood of a parathyroidectomized dog, and Hanson in 1924 and Collip in 1925 reported the preparation of a potent parathyroid extract which was injected with successful results to animals deprived of their parathyroid glands. The subcutaneous injection of this acid extract caused a marked increase of blood calcium, inorganic phosphorus and nonprotein nitrogen.

It has been found that parathyroids enlarged slightly in experimental rickets and also in lactation and in pregnancy.

The treatment of tetany is best carried out by the administration of calcium, either in the form of calcium lactate or in milk. It has recently been demonstrated that calcium in milk or given in solution is absorbed much better with the addition of lactose (milk sugar). In some instances parathormone given subcutaneously gave satisfactory results.

Although the parathyroid hormone is essentially a blood calcium mobilizer, Hunter and Aub report excellent results in its use to aid in the elimination of lead in lead poisoning.

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EDITORIALS

The American Board of Orthodontia

AT THE meeting of the American Society of Orthodontists at Estes Park, July, 1929, President Ketcham recommended the creation of an American Board of Orthodontia, similar to the American Board of Otolaryngology. The American Board of Otolaryngology has been functioning for a number of years. The purpose of said Board is to standardize the qualifications for those engaged in the specialty of otolaryngology.

The commitee appointed to consider the president's recommendation submitted the following resolution:

WHEREAS, the President has recommended the formation of an American Board of Orthodontia similar to the American Board of Otolaryngology and similar boards formed for the purpose of regulating the specialties of medi-

cine, which boards have rendered valuable service in standardizing and increasing the efficiency of medical specialists; and

WHEREAS, up to this time those engaged in the practice of orthodontia have had varying and sometimes insufficient qualifications for the practice of our specialty; and

WHEREAS, the need of a high order of training is essential to orthodontic practice; and

WHEREAS, there is a need for a body to designate standards of study and other qualifications for those who are to represent the specialty of orthodontia; be it therefore

Resolved: That the American Society of Orthodontists create and sponsor an organization to be known as the American Board of Orthodontia, which shall consist of seven men of unquestionable and outstanding reputation and accomplishment in the science of orthodontia, who shall be nominated by the Executive Committee and elected by the general assembly at large; one to serve for a period of one year, one to serve for a period of two years, one to serve for a period of three years, one to serve for a period of four years, one to serve for a period of five years, one to serve for a period of six years, and one to serve for a period of seven years; and one to be elected annually thereafter to serve for a period of seven years. The nominations made by the Executive Committee shall not be voted upon until the following day thereafter. Three-fourths of the votes cast shall be necessary to elect a nominee a member of the American Board of Orthodontia. The Board shall organize and make rules regarding the requirements for examination of candidates, for the granting of certificates of fitness, and to make such other rules and regulations as it may deem necessary for the proper functioning of the Board.

After some discussion the above resolution was adopted.

The entire membership of the American Society of Orthodontists have a voice in naming the members of the Board. The first safeguard is that the members for the Board are nominated by the Executive Committee and shall not be voted on until the day following the nomination. The chairman of the committee that reported upon the president's recommendation informed the members of the American Society of Orthodontists that the nominations made by the Executive Committee were not final. The Executive Committee is nothing more than a nominating committee and any member of the American Society of Orthodontists may make nominations other than those made by the Executive Committee. In order to establish this ruling, the president, at the time the nominations were made by the Executive Committee, asked if there were other nominations. The next day, before voting upon the nominees selected by the Executive Committee, the president again asked if there were other nominations. By such procedure the Executive Committee will not be able to fill the American Board of Orthodontia with members that are not satisfactory to the general membership of the American Society of Orthodontists.

The object of the American Board of Orthodontia is to grant certificates of fitness to those men engaged in orthodontia as a specialty. It is likely that

the plan of this Board will be to provide for three classes of applicants. The first class will consist of those who have been in the practice of orthodontia for fifteen years or more and who occupy an unquestionable position in the specialty. It will include those men who have contributed to the advancement of orthodontia by perfecting methods of practice and by contributions to orthodontic literature. Such men may be granted certificates of fitness upon their professional records. The second class will include those who have specialized in orthodontia for seven years and less than fifteen years. These men will have to present the same evidence as the first group, in addition the Board may examine them or require them to present a certain number of case reports, or both. The third group will probably include those who have specialized in orthodontia for three years and less than seven years. They will be examined as to their educational training, their professional training and their methods of practice. References from men in the dental profession and in the community will also be required.

While these rules have not been adopted by the American Board of Orthodontia as final, they have been discussed and will probably be followed.

It is the intention of this Board to avoid the danger of granting certificates of fitness in a wholesale manner. To prove this, we will cite the fact that a member of the American Society of Orthodontists suggested that all the members of the American Board of Orthodontia should automatically be granted certificates of fitness. In answer to this, the chairman of the committee stated that no member of the first Board of Orthodontia could receive a certificate of fitness until after his term had expired, and then he must present the same evidence required from those in the group to which he belongs.

The members of the American Board of Orthodontia met after their election and elected Dr. Albert E. Ketcham, president, and Dr. B. Frank Gray, secretary. The Board, under the direction of the president, is working on suitable application blanks which will be sent to those who desire them in the near future. The first group of applicants will be examined at the meeting of the American Society of Orthodontists at Nashville, Tennessee.

It is our belief that the American Board of Orthodontia will do more toward standardizing the specialty of orthodontia than anything that has ever been done by the profession before.

ORTHODONTIC NEWS AND NOTES

Greater New York December Meeting for Better Dentistry

The First and Second District Dental Societies will continue the series of meetings which were formerly conducted by the First District Dental Society and widely known as the "December Meeting for Better Dentistry."

The meeting this year which is the Fifth Annual Meeting will therefore be conducted jointly by the two societies at the Hotel Pennsylvania, December 9-13, 1929.

Among the essayists and clinicians who have accepted invitations to be present are: Doctors Wallace Seccombe, Toronto; J. R. Blayney, Chicago; Chalmers J. Lyons, Ann Arbor: Charles A. Lane, Detroit; Albert L. LeGro, Detroit; Dayton D. Campbell, Kansas City; James M. Prime, Omaha; Hugh W. MacMillan, Cincinnati; P. Kyprie, Detroit; John B. LaDue, Chicago; and Theodore W. Maves, Cleveland.

The meeting will be continued on the same plan as previous meetings, namely, $5.00 admits members to all lectures, clinics, etc.

A subscription blank and list of clinics will be ready for circulation November 1.

There will be a manufacturers' exhibit in the hotel during the meeting.

JOHN T. HANKS, Chairman.

Dewey Alumni Society

The annual scientific session of the Dewey Alumni Society will be held in New York City the week of November 11, 1929.

The first four days will be devoted to post-graduate instruction, including Diagnosis, Treatment and Appliance Design. The technical side of this work will be under the supervision of Dr. Oren A. Oliver, assisted by Dr. Claude Wood. Dr. Dewey will deliver lectures on Etiology, Diagnosis and Treatment. November 15 and 16 will be devoted to scientific papers.

As only a limited number can be accepted for the first four days of instruction on Diagnosis and Treatment, applications will be honored in order of their receipt.—Russel E. Irish, President, Otto J. Sorenson, Secretary, 17 Park Avenue, New York City.

Dental Society of the State of New York

The Dental Society of the State of New York will hold its Sixty-second Annual Meeting May 13, 14, 15, and 16, 1930, at Hotel Commodore, New York City.

A cordial invitation is extended to all ethical dentists, residents in the United States and Canada. Exhibitors desiring space please address Dr. T. C. Swift, 1 Park Avenue, Mt. Vernon, New York. Please apply early for information and space.

The usual preliminary program will be issued in January, 1930, and the official program in April, 1930. For further information address the Secretary, A. P. Burkhart, 57 E. Genesee Street, Auburn, N. Y.